the OIL AND GAS JOURNAL

APRIL 8, 1957

ELECTRONIC WATCHMAN for Pipelines

...now used at local level... p.88

What Producers Want From Texas Pipelines · 63

"Mr. Gus" Capsizes Off the Coast of Texas · 66

Court Tackles Offshore Dispute This Week · 68

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JOURNAL News Letter

April 8, 1957
Tulsa, Oklahoma

A new oil wage pattern is emerging:

It appears a 5 per cent pay increase will be the basis on which oil management and unions will settle new contracts. That's becoming the most frequently mentioned compromise figure. It will mean 13-1/2 cents an hour more for the workers but only half of the original 27-cent an hour demand of the unions.

Indications are after 4 months of dickering, the big O.C.A.W. and some of the smaller independent unions may be ready to accept new contracts for 5 per cent more. Socony Mobil set the pace by offering that to its striking O.C.A.W. marketing employes in Detroit. Magnolia workers have been made the same offer. Central States Petroleum Union, independent representing 12,000 Indiana Standard employees, says it will accept a 5 per cent offer but not 4 per cent given other independents at Indiana's Whiting refinery earlier.

There's a lesson in the epic of "Mr. Gus."

That illustrious offshore drilling platform--one of the biggest and most expensive ever built--capsized in a gulf storm off Texas last week (P. 66). Plans are now being studied to salvage the $3-1/2 million pile of twisted steel and machinery from 40 ft. of water.

Here's how the heart-breaking incident happened: In preparing to move off location 30 miles south of Corpus Christi, the unit tipped 8° when the gulf floor gave way. For a time, a big Crane barge summoned in the emergency held Mr. Gus in place. During the night a sudden storm with 40-mile winds came up and finally keeled over the 20-story high structure. Oddly, Mr. Gus was designed to withstand 125 mile an hour hurricanes.

The loss underscores what oil men have been learning for some time: Bringing oil up from the gulf is a risky and expensive undertaking. Men have gambled with the sea for centuries--and with oil for decades. Now that they're gambling with both at the same time, the risks are staggering.

Arguments are starting before the U.S. Supreme Court in the celebrated dispute between the federal Government and Louisiana over ownership of oil-rich offshore lands (P. 68). Big issue before the court now is whether Louisiana is entitled to 3 miles or 3 leagues out from its coast. What may not be settled is another dispute: Just where the Louisiana coast begins.

Oil's stake in the fight is this: No matter what the decision, it will remove a 7-1/2-mile strip from the disputed area.

Diplomats in Washington are reading with interest the proposal of an international oil consultant that the U. S. foreign policy in the Middle East be geared to stand squarely behind rights of private oil companies. The proposal was made by New York consultant J. Walter Levy. He also suggests that the U.S. create common interests between the Middle East and West and move to reduce the West's vulnerability to a break in the flow of oil.

On oil vulnerability, Levy suggests: More tanker capacity and alternate pipelines, greater productive reserves outside the Middle East, and more storage for Middle East crude in consuming European countries. He says a firm and fair policy is needed because the way things stand now neither the oil companies nor the Government know how to proceed.

Are crude prices being undercut?

That rumor was abroad for a time last week. It apparently stemmed from one isolated incident: Some low gravity, high-asphalt Wyoming crude reportedly was offered at a cut-rate price in the Wood River area. But crude buyers report it's not a trend. The oil had been moved to the Mississippi River by uneconomic transportation in the oil-lift emergency. It was caught there when the demand slackened. The price cut was an attempt to remove it from storage.

But it does point to upcoming market and production adjustments the industry must start making in the days ahead when the Middle East oil flow is resumed.

PRODUCTION men will want to follow this development closely: One company is getting ready to apply to the Texas Railroad Commission for a permit to try the first combination miscible-phase water-flood project. It'll be in a West Texas field. And here's the fantastic part: Engineers estimate they'll recover one billion more barrels of oil than possible with primary methods.

The program, which is being kept under wraps until it is officially filed calls for injection of a slug of propane first. This will be followed by natural gas and then water. The same idea reportedly is being studied by operators of a major Texas water-flood. They already are injecting water, but may add miscible-phase too.

Shell Oil engineers have come up with a one-well measuring separator that can be installed for less than $300. It's simple and has proved trouble free and sufficiently accurate in use in the Big Foot field of Frio County, Tex. It may be the answer for other operators who have large leases with a lot of low-production wells. Shell reports the device gives: Daily well tests and quick detection of wells off full production. It also can be used as possible future aid to pumpoff control (P. 110).

The world's first offshore microwave system is being tested by Magnolia in the gulf off Morgan City, La. System covers almost 80 miles in four hops and links production facilities of Magnolia, Continental, and Newmont. Engineers think the system will whip signal fading, which has dogged over-water microwave use in the past.

Shadows of foreign imports are hanging over the Texas Railroad Commission's big hearing into the battle between PIPELINES and producers over the unconnected-well problem in West Texas (P. 63).

Independent producers are having their say first. Their arguments run like this: Pipelines are refusing to connect wells, run new gathering lines, or expand trunk-line capacity. The lines are being operated illegally as private carriers, and producers are being unfairly discriminated against.

But crux of the producers' case: The big trunk crude lines in Texas are controlled by nine companies which also are common purchasers. These same companies are heavy importers of foreign crude. They are more interested in selling their foreign crude in the American market than expanding to handle rival domestic oil.

The pipeline companies will come to bat next.

Don't count out of the picture a second pipeline from the Four Corners area. Many oil men thought Four Corners Pipe Line Co. had an insurmountable jump 2 weeks ago when it started surveying a 600-mile route for a crude line westward to Los Angeles. But Texas-New Mexico Pipe Line Co. wouldn't quit. It has let contract for immediate surveys on a 517-mile route running southeast to Jal, N.M. There it will tie into existing crude systems. Combined capacity of the two lines would be 110,000 bbl. daily, far more than present production in the region.

Automatic equipment is proving successful for supervisory control over short distances at local pipeline stations. Using techniques learned from remote-control work, Service Pipe Line is first to apply the local-control method. System used at its Fort Laramie station shows these advantages: Fewer employes, lower operating costs, short equipment payout, and ease of expansion (P. 88).

Rotary-percussion DRILLING will get new shakedown tests next month. Backers of the fast-drilling idea think this time it has better-than-average chances of making the grade.

Drilling Research, Inc., engineers put a completely reworked tool together last week for testing at Battele Memorial Institute. They have spent a year and a half working out bugs which cropped up during 1954 tests. At that time the vibrating bit chewed through hard formations at shallow depths at nearly four times the speed of conventional tools. But trouble always developed when sections of drill string were added for deeper drilling.

Drillers and operators alike may be startled by this latest expert claim: Time lost waiting on cement can be reduced to 12 hours without hurting well operations. In fact, current industry practices on this score are lagging behind modern oil-well-cementing technology (P. 99).

Operators in the Ventura Avenue field near Los Angeles face real trouble. Deeper development is being threatened by frequent well failures. Current pipe headaches include mechanical failure of liners, sand which clogs or cuts liners, and asphalt deposits in bore hole, tubing, and surface equipment. Attacks on the problem so far include: Use of heavy-walled, high-strength liners...eliminating liners in producing zones by using open-hole gravel packs ...and providing stress-relief joints in the liners (P. 96).

The Soviet turbodrill, even the Russians now admit, is not the answer to all drilling problems. Engineers there have found that combining turbo-drilling and rotary drilling gives these advantages: Faster over-all drilling speeds, fewer bits, and less use of chemicals and weighting material. The formula for split drilling is: Use the turbodrill to cut hard rock. Use the rotary for uniformly soft rock and clay formations, where it has proved superior. This means the operator must know an area's geological profile before he can tell what tool to use.

Shell EXPLORATION team apparently has opened a new basin in the Texas Panhandle. Its 1 Alamosa Ranch, 14 miles north of Vega in the rugged Palo Dura basin, appears to be a Pennsylvania-lime producer at 6,095 ft. Nearest production is 40 miles north in Hartley County's Rehm field.

Eastern Peru's new discovery may be the long-awaited success that will crack the country's Amazon basin. El Oriente's 1 Maquia, 3 miles east of the Ucayali River near Contanama, is the first Peruvian discovery east of the Andes since 1938, when Ganso Azul was discovered.

Latest word from new Venezuelan concessions says the much-coveted Block 10 in Lake Maracaibo has been won by a combine of Phillips, San Jacinto, El Paso Natural, Sunray, and Pacific Petroleums. It's reported to be the most expensive block in the lake... Pan American also is reported to have been awarded Block 11 in Southern Monagas.

Interest is picking up in the high-energy synthetic fuels.

Gulf Oil now has entered the field and proposes to get out front with new work in alkyl boranes. This was revealed when Gulf bought a 25 per cent interest in Callery Chemical Co. and announced plans for joint research with Callery's parent, Mine Safety Appliances Co.

Callery Chemical currently is building a $38 million plant at Muskogee, Okla., under Navy contract to produce HiCal. Different from any other fuels, HiCal is a combination of boron, carbon, and hydrogen. Its extremely high energy characteristics increase aircraft efficiency and permit higher altitude flying.

Refiners plan to keep an eye on these possible competing fuels but feel they post no threat to petroleum fuels now or for several years to come.

The all-aluminum engine may be near. Development of new methods in die-casting has cut cost of fabricating aluminum crankcases and cylinder heads. It has also permitted application of magnesium parts. Introduction of these engines into autos on a mass scale could ease the pressures for higher octanes. Increased horsepower per cubic inch and weight savings are promised along with slight advantages in octane gain.

Beefed-up premium gasoline is making appearances in more pumps across the country. Ethyl's survey shows the number of stations handling 99-plus octane gasoline nearly doubled in March. Meanwhile the octane averages climbed. The average premium was 97.5 and regular 90.5.

Here's an interesting bit of statistics: When Tidewater's new Delaware City refinery finally goes on stream, it will have $1,500,000 worth of platinum catalyst in its veins.

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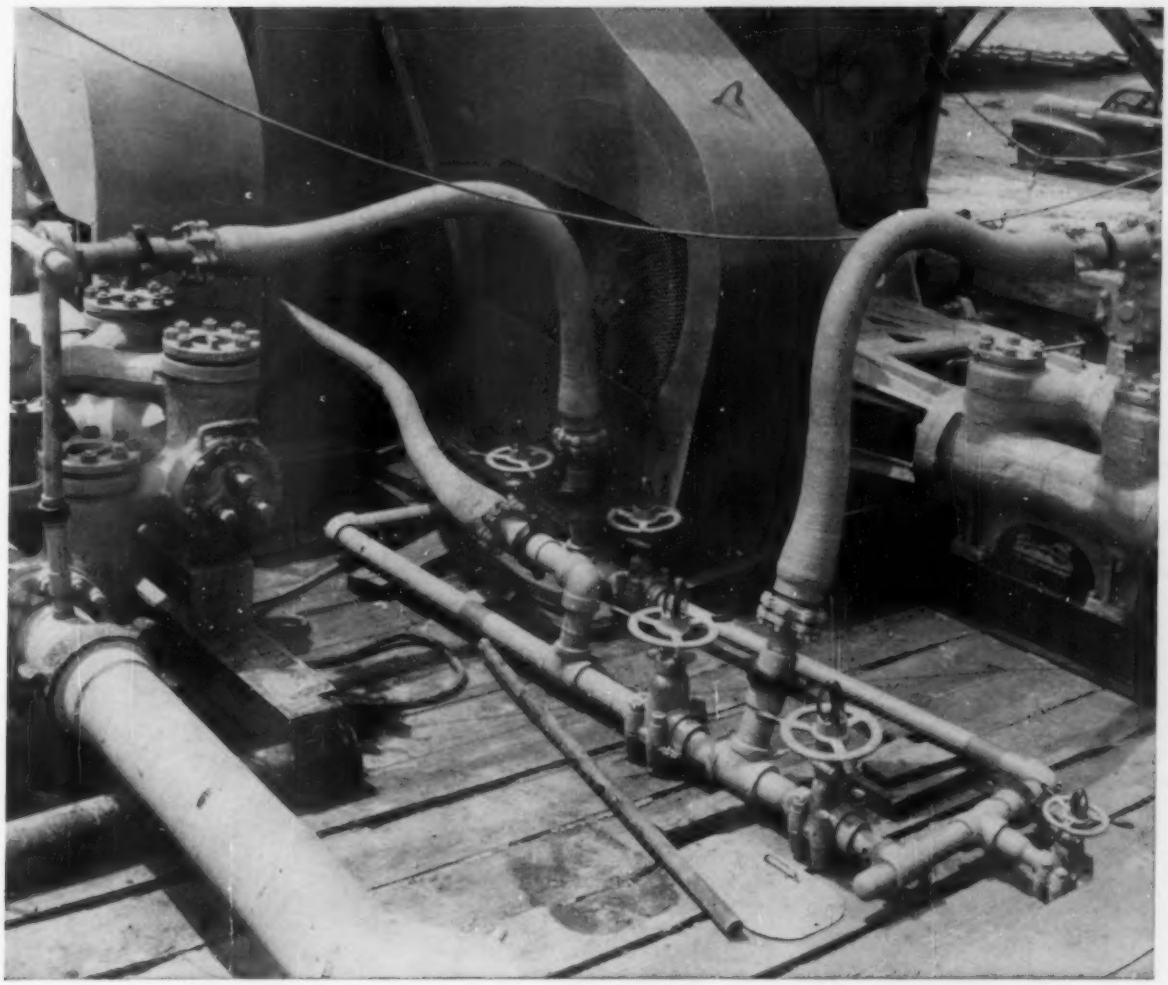

This hose stands vibration, resists abrasion better than steel

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the OIL AND GAS JOURNAL

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OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
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TECHNOLOGY—OPERATION

Pipelining

Supervisory Control Goes Local ... **88**
By P. P. Plovanich and E. E. Hogwood

Supervisory control is applied over short distances for local, rather than remote, station control at the Fort Laramie station of Service Pipe Line Co. Advantages: fewer operating personnel, lower operating costs, short payout, and ease of expansion.

Pipeline Patrol: New Methods for Welding Line Pipe ... **129**

After forming, the pipe is tack-welded. Then the i.d. weld is applied. The o.d. weld follows, and the pipe is expanded in the usual manner. This eliminates necessity of special end welds and requires minimum amount of tack welding.

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By Larry Resen

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How to Reduce Waiting-on-Cement Time ... **99**
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The one-well measuring separator developed by Shell Oil Co. can be installed for as little as $300. It is simple, trouble-free and accurate.

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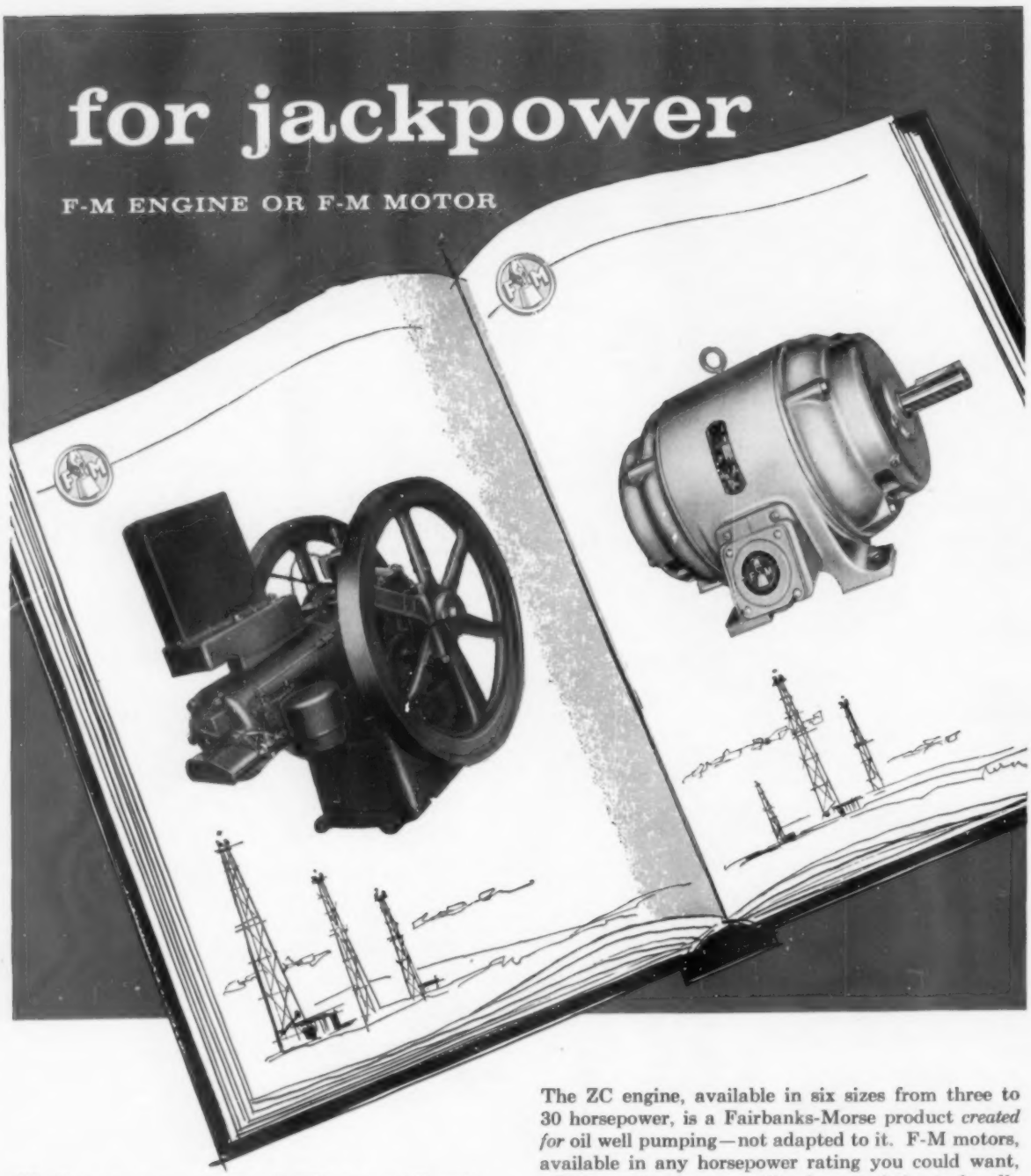

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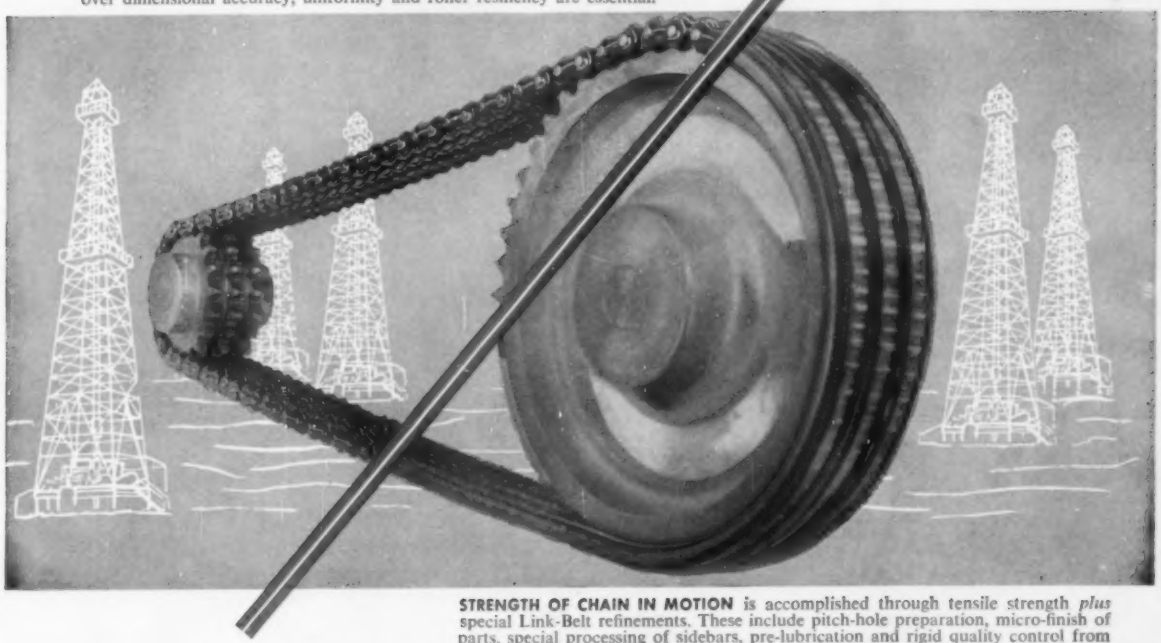

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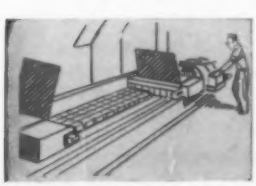

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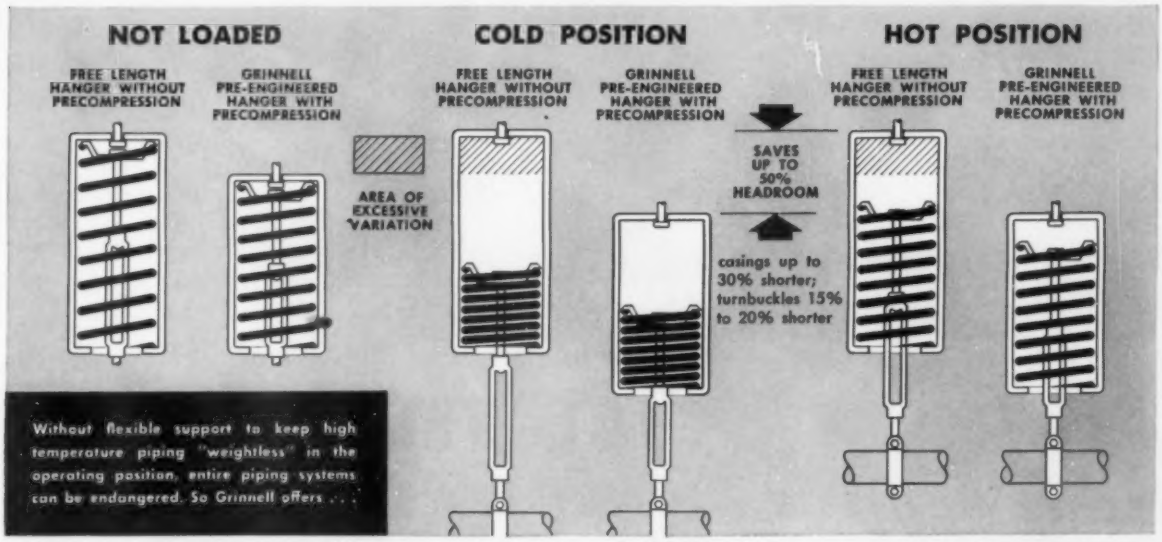
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Precompressed Hangers for Safer Support of Piping

Helical coil springs are widely used in hangers for flexible support of piping which moves up or down during thermal expansion. The A.S.A. code for pressure piping requires that variable spring hangers support at least a minimum of 75% of the pipe's weight for a pipe that rises (relaxing the spring) and no more than 125% of the pipe's weight for a pipe that lowers (compressing the spring) during operation.

Precompression patented Grinnell principle

To guard against the spring's supporting force exceeding the limits of variation, Grinnell developed and patented a variable spring hanger design. The steel casing holds the spring permanently precompressed, at the threshold of the hanger's working load range. This prevents the spring decompressing into its area of excessive variation.

Pre-set is not a substitute

As a partial substitute for this patented precompression, some manufacturers insert a spacer between the top end of a free-length hanger casing and the spring to hold the spring's height temporarily within the working range during shipment and erection.

Another device requires the manufacturer to drill symmetrically opposite holes in the casing walls and insert a bolt to hold the spring's height within the working range. When these devices are removed from the hanger and discarded, the spring can decompress, resulting in high variability in supporting force.

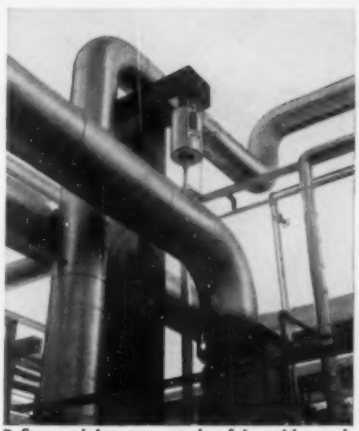
Cold-setting a universal factory service

For the erection crew to avoid having to compress the spring down to the erected position, the manufacturer can compress the spring down to this height. Grinnell can provide a cold-set bolt in precompressed hangers.

Less headroom required by Grinnell Hangers

Shorter hanger casings made possible by Grinnell's patented precompression, reduce bulk shipping weight and required headroom by eliminating undesirable height. Installation is simplified by this shorter casing and also by an integral load scale with load indicator.

Additional headroom is saved by a correspondingly shorter turnbuckle. These precompression advantages are available in short spring and double spring models as well as standard spring models.



Refinery piping supported safely, with ample flexibility but low headroom.

Available in 63 standard units

Grinnell Variable Spring Hangers are available in 21 sizes each of short, standard and double spring models . . . for maximum travel of 1¼, 2½ and 5 inches respectively within working load ranges. Load capacities extend from 43 lbs to 30,550 lbs. The maximum variation in the standard size per ½-inch deflection is 10½% of rated capacity; inversely proportional in short spring and double spring models.

For further information

If you have a pipe suspension problem, you are invited to write: — Grinnell Company, Inc., 246 West Exchange Street, Providence, R. I.

IS THERE REALLY A DIFFERENCE?

J&L WELDED PIPE

Your J&L store has well-balanced stocks of welded pipe.

It is inherent with J&L men to appreciate your pipe business — and that goes for a nipple, a joint, or a carload.

There you have two important advantages offered you by J&L which have nothing to do with the quality of the product.

But the quality is there, too. J&L makes every length of butt-weld and lap-weld as though it were going straight into critical service. Sometimes it does, and in such circumstances it adds to the pleasurable experience you had when you bought it. It measures up to any crisis which pipe of its kind is intended to meet.

This is a third important advantage offered you in welded pipe by J&L.

It is assuring to remember in buying tubular goods of any kind, butt-weld, lap-weld, electric-weld or seamless, that J&L has made things of iron and steel for more than a hundred years.

Jones & Laughlin

SUPPLY DIVISION – Tulsa

SERVING THE UNITED STATES AND CANADA

No. 107-S

WHY OILMEN DEPEND UPON OLIVER

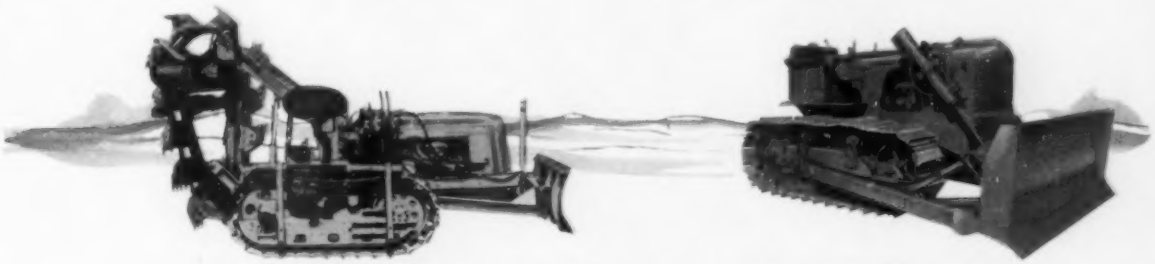
for the rugged jobs...for lowest costs

• In the oil fields, along the pipelines and in refineries all across the country these Olivers have proved that they have what it takes to get jobs done on time—and without pampering. Backed by over 50 years of tractor-building experience, these newest Olivers have the ruggedness, the versatility and the job-speeding features that put you ahead of competition on any assignment. Crawler tractors range from 21.8 to 133 drawbar h.p.; wheel tractors from 29 to 77 d.b.h.p.

10 different crawler and wheel tractor models with every attachment you need

OC-46 LOADER WITH JET-TRENCHER—21.8 drawbar h.p.; ⅝-yd. loader bucket. Jet-Trencher is mounted or removed in 90 sec.

"LITTLE BOOMER"—2000-lb. lifting-carrying capacity. Also mounts dozer, pipe bending shoes, winch, etc. Model OC-12 side boom handles 13,000 lb.



UNIVERSAL TRENCHER—digs up to 4′ deep and 18″ wide; 8 digging speeds. Hydraulic control with all features for low-cost trenching.

OC-12 WITH POWER-TURN STEERING—53 d.b.h.p.; available with dozer, angleblade, side boom and other attachments.

SUPER 88 HYDRO-TRENCHER—a fast-working ½-yd. back hoe, digs to 12′ depth. Dual hydraulic control provides smooth, efficient production. Also converts as shovel.

SUPER 55—sized for hundreds of jobs; 6 travel speeds; available with a full complement of attachments for lifting, loading, carrying, digging, etc.

Ask your Oliver distributor to demonstrate or write for literature.

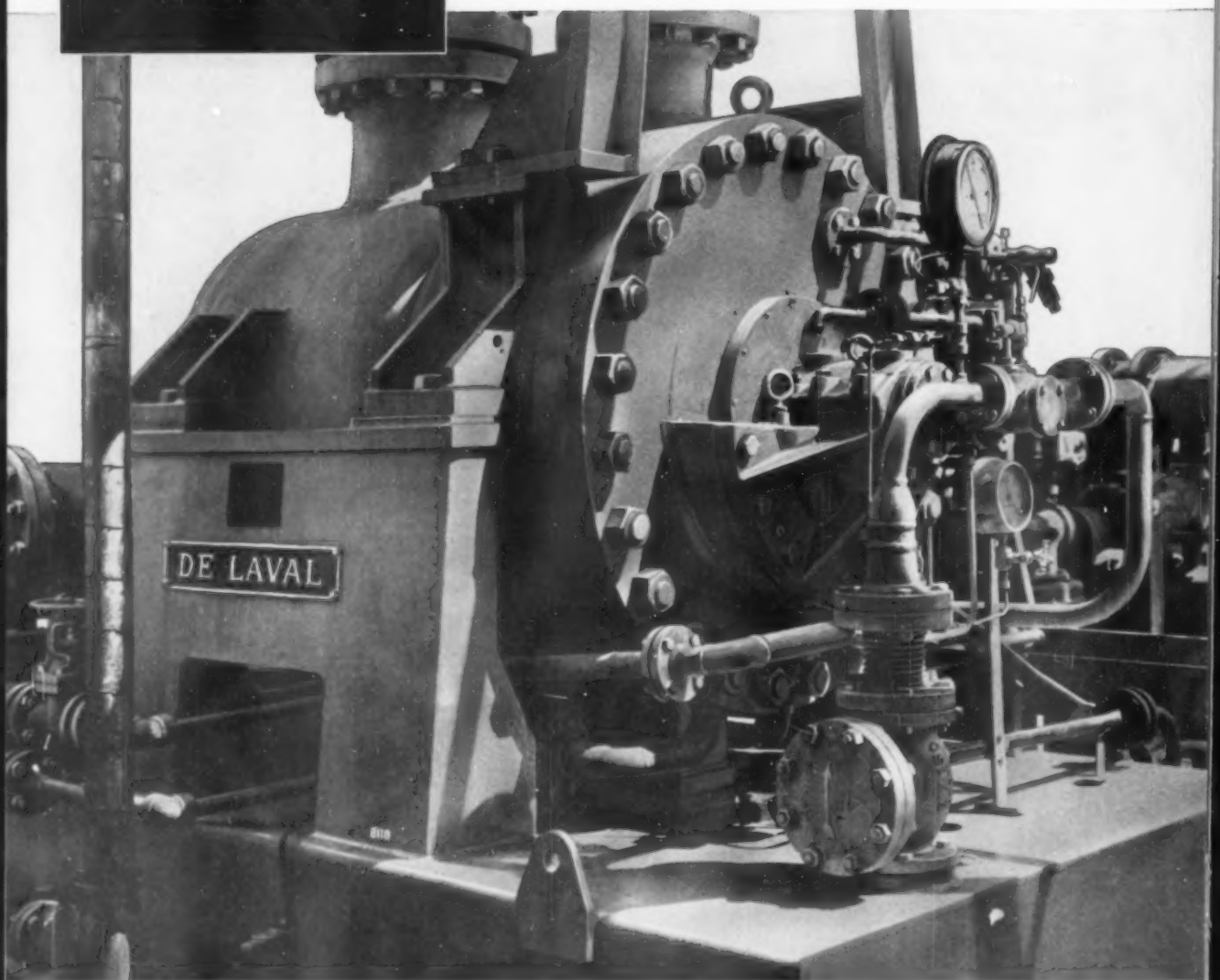
THE OLIVER CORPORATION
400 West Madison Street, Chicago 6, Illinois

OLIVER

A complete line of industrial wheel and crawler tractors and matched allied equipment

DE LAVAL
BARREL TYPE REFINERY COMPRESSOR

handles hydrogen under high pressures in a reformer at General Petroleum



Send for new Bulletin 0504

This De Laval centrifugal recycle barrel type compressor is doing a dependable job handling hydrogen under high pressures at the General Petroleum plant in Ferndale, Washington. It takes hydrogen at an inlet pressure of 500 psig and discharges it at 625 psig. The unit is driven by a 1110 hp turbine operating at 9900 rpm.

General Petroleum Corporation is only one of many refiners who have specified De Laval Compressors. Whether you need to handle light or heavy gases at high or low pressures in catalytic cracking, reforming, alkylation, coking or any similar service, it pays to look to De Laval. Rugged De Laval centrifugal compressors perform dependably in heavy-duty continuous operation. De Laval has more than 40 years of experience in solving gas compression problems.

DE LAVAL *Centrifugal Compressors*

DE LAVAL STEAM TURBINE COMPANY
810 Nottingham Way, Trenton 2, New Jersey

DL-367

Unique combination of fine engineering and economy!

...the new FOXBORO M/44 INDICATING PRESSURE TRANSMITTER

- **Easier to Read . . . large indicator scale, visible at 20 ft.**
- **Easier to Calibrate . . . simple adjustments "on location"**
- **More Compact . . . single, integral instrument**

Any way you look at it, the new Foxboro M/44 Pneumatic Pressure Transmitter gives you an unmatched combination of fine engineering and economy. First; because it *is* an engineered instrument. There are no attachments or "makeshifts". Second; because it utilizes standard Foxboro parts throughout—parts which have been performance-proved in thousands of successful installations of other Foxboro Instruments. And this means not only top performance, but easier servicing and stocking as well. Third; calibration is simple, right in the field, because the M/44 is "convenience-designed" by men with years of experience in every phase of instrument design and application.

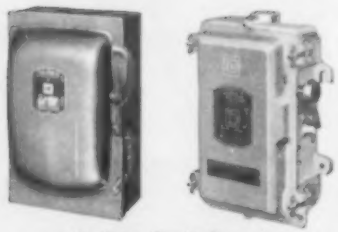
In appearance, too, the M/44 has unmistakable Foxboro quality. Features like the high-legibility indicator scale, the compact drawn-steel case with tough polyester plastic cover. It's the neat, high-efficiency, low-cost pressure transmitter for centralized operation or control. All standard ranges.

Write for complete details

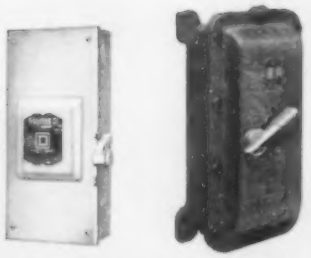
THE FOXBORO COMPANY
604 Neponset Ave., Foxboro, Mass.

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

FOXBORO
REG. U.S. PAT. OFF.
INSTRUMENTATION FOR INDUSTRY



• Safety Switches in General Purpose and Special Purpose Enclosures



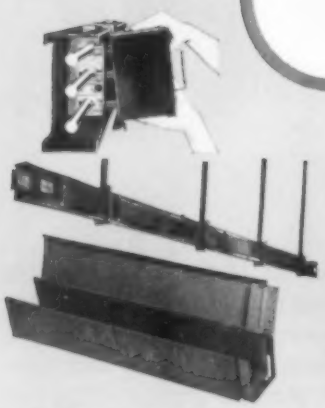
• Industrial Circuit Breakers in General Purpose and Special Purpose Enclosures

• Voltage Testers

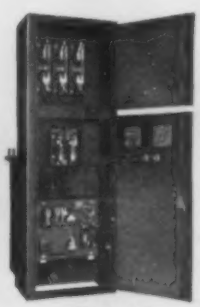
• Fusible and Circuit Breaker Lighting and Power Panelboards

• Power Distribution Switchboards and Switchgear

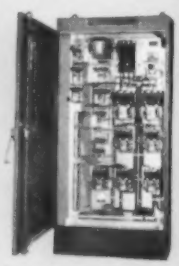
Wherever Electricity



• Busways and Wireways



• EC&M High Voltage Synchronous Starters



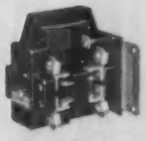
• Special Purpose Control

• Control Centers

SQUARE D COMPANY

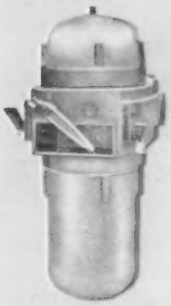
• A.C. Manual and Magnetic Starters in General Purpose and Special Purpose Enclosures

• Limit Switches



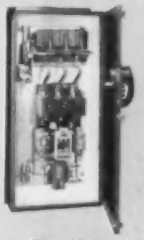
• Control Relays

• Timing Relays

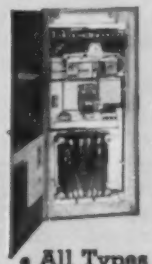


• Starters for Hazardous Locations

• Pushbuttons

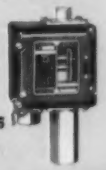


• Combination Starters in General Purpose and Special Purpose Enclosures



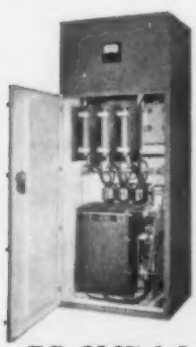
• All Types of Reduced Voltage Starters

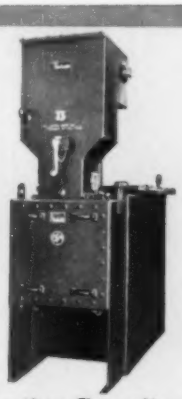
• Oil Field Pumping Plant Panels



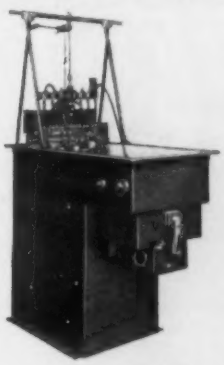
• Float & Pressure Controls for Pumps & Compressors

is Distributed and Controlled





• EC&M High Interrupting Capacity Starters. Air-Break *(left)* and Explosion-Resisting *(right)*



• EC&M 2200-4800 Volt Starters for Division 2 Hazardous Locations

DESIGN LEADERSHIP FOR MORE THAN 50 YEARS

ECONOMICAL FROM EVERY ANGLE

'AMERICAN' "Every Angle" THERMOMETERS

No longer is it necessary to fuss and figure what angles of stem connection are required in thermometers for each location. These American "Every Angle" Dial Thermometers can be set at any angle within 180° on *two* axes – set at the best angle for easiest reading.

Regardless of what piping arrangements are engineered into your processes – no matter how many times they are revised – the list of American "Every Angle" Thermometers in your original specifications need not be changed. Equally important, your thermometer inventory in all required temperature ranges and stem lengths will be far smaller. That's real economy – from every angle.

Bi-metal . . . mercury . . . vapor pressure – all three types of actuation are available in American "Every Angle" Dial Thermometers. They are precision instruments that assure accuracy within 1% of scale range. Their high accuracy is sustained throughout service life, whether installed indoors or outdoors.

Make full use of these highly sensitive thermometers at all important check points in your plant. You will maintain product quality far better than ever before. Your field operators will be able to take readings more easily, more accurately, more frequently – will save time-stealing trips to the control house. Convince yourself of the all-around economy of American "Every Angle" Dial Thermometers. Write for complete information.

BI-METAL ACTUATED, TYPE 6060AH. 5" Anti-Parallax Maxivision Dial. **Temperature Ranges:** –80/120 F. to +200/1000° F. **Stem Lengths:** 4" to 24". Climate-proof stainless steel case.

MERCURY ACTUATED, TYPE 6042RM. 4½" Anti-Parallax Maxivision Dial. **Temperature Ranges:** –20/120° F. to 200/1000° F. **Stem Lengths:** 4" to 24". Climate-proof glass and stainless steel case.

VAPOR PRESSURE ACTUATED, TYPE 6040TW. 3½" Dial. **Temperature Ranges:** –20/120° F. to 260/450° F. **Stem Lengths:** 3" to 24". Models for indoor or outdoor service.

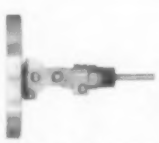
Separable sockets can be supplied in all materials and sizes normally required.

SET-ABILITY THAT MEANS FLEXIBILITY IN APPLICATION

SET IT for use as a side angle, 90°, oblique or top connection thermometer.

SET IT for use as a straight-form thermometer.

SET IT for use as an oblique-form thermometer.



SET IT for use as a standard 90° back-connected thermometer.

CALL ON YOUR INDUSTRIAL SUPPLY DISTRIBUTOR for experienced counsel in dial thermometer selection. You can depend on him for prompt delivery from local stocks.

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

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A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONN.

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Okla.* AIRCRAFT CONTROL PRODUCTS, *Danbury, Conn., and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

NEW RELIANCE P-BASE MOTORS

Designed for outdoor and indoor installations

THESE RELIANCE FEATURES offer you the best motor for your pump installations.

Totally-Protected, weather tight construction—Corrosion-proof cast iron housing and sealed conduit box with threaded inlet locks out water, dust and foreign matter.

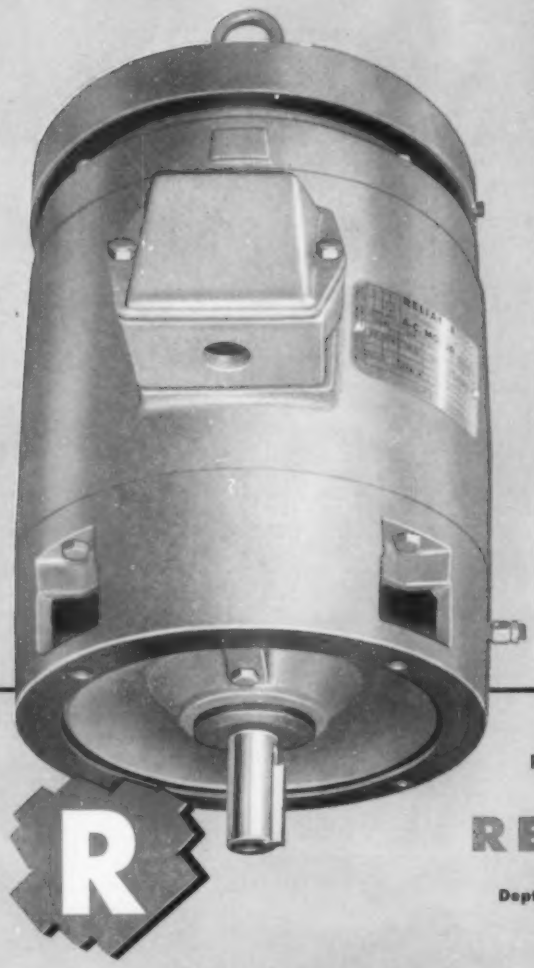
Perfect pump seating—True fit machined motor flange mates perfectly with pump flange, eliminating wear from misalignment.

Life long bearing protection—Special oversized thrust bearings designed for vertical operation are protected with Metermatic lubrication; you can't grease 'em wrong.

Shaft sealed—Neoprene shaft slinger protects windings from foreign matter creeping up the shaft.

Enclosures for every application—Protected, totally-enclosed, and explosion-proof, Cl. I Gr. D, Cl. II Grs. E, F, & G enclosures available, 1-30 hp. all electrical characteristics.

B-1530



Totally-Enclosed, Corrosion-Proof

Protected

Explosion-Proof
Cl. I, Gr. D
Cl. II, Grs. E, F, & G

Write for bulletin B-2502 and check the facts on why Reliance Totally-Protected P-Base Motors are your best buy.

RELIANCE ELECTRIC AND ENGINEERING CO.

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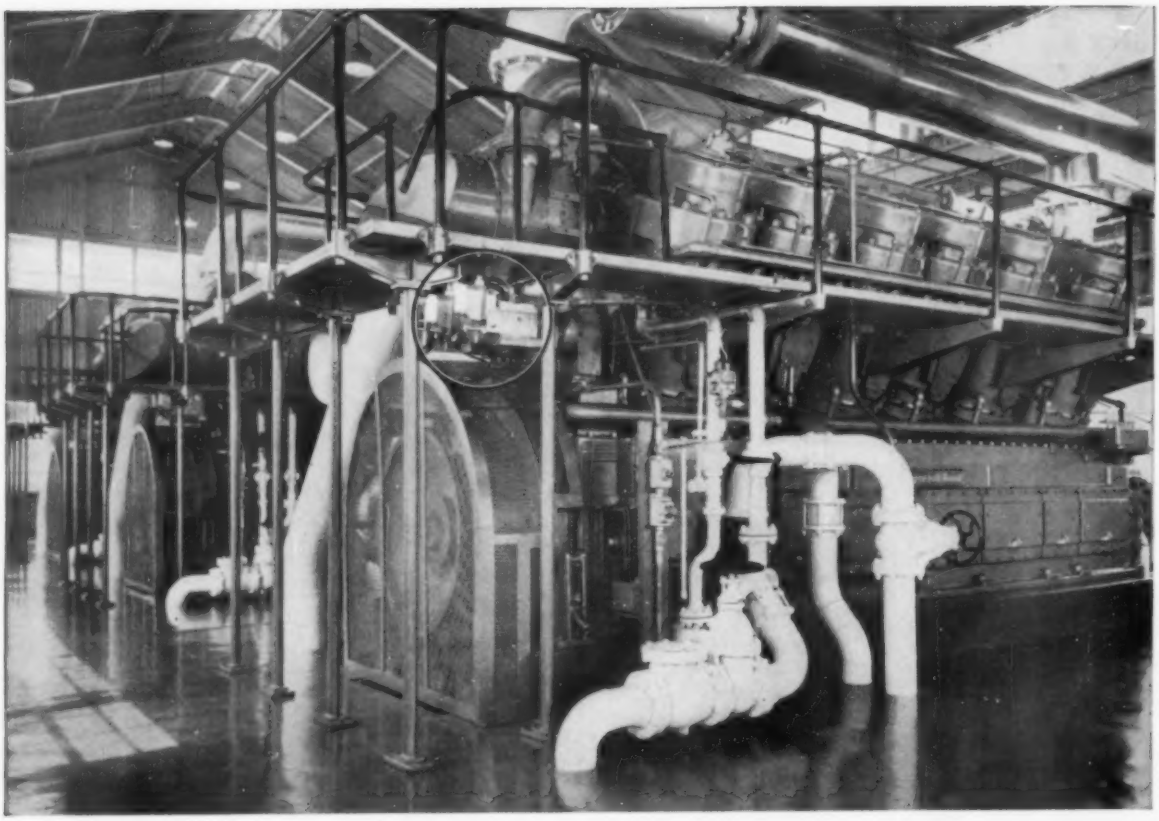

SERVING TRUNKLINE GAS COMPANY OF HOUSTON —A VITAL LINK IN THE NATION'S ECONOMY!

Trunkline Gas Company of Houston, Texas, operates a natural gas transmission line extending from near McAllen, Texas, to Tuscola in central Illinois where it connects with the line of the Panhandle Eastern Company.

This gas line crosses Texas, Louisiana, Arkansas, Mississippi, Tennessee, Kentucky, and the southern half of Illinois —a vital link in the nation's economy.

Helping to serve this very important segment of the nation's natural gas transmission system is the battery of Ingersoll-Rand 412 KVS engines equipped with Bendix DLC6 magnetos and Bendix HI-V transformer coils (illustrated at left) in Trunkline's Cypress Compressor Station near Houston.

The Bendix DLC6 magneto is a completely new type of magneto, incorporating the latest engineering design. Together with the Bendix HI-V transformer coil it becomes a matched ignition system that delivers more than ample voltage with greatly reduced maintenance cost.

SCINTILLA DIVISION OF BENDIX AVIATION CORPORATION, SIDNEY, N. Y.

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Scintilla Division
SIDNEY, N.Y.

Bendix
AVIATION CORPORATION

TEST! BEST!

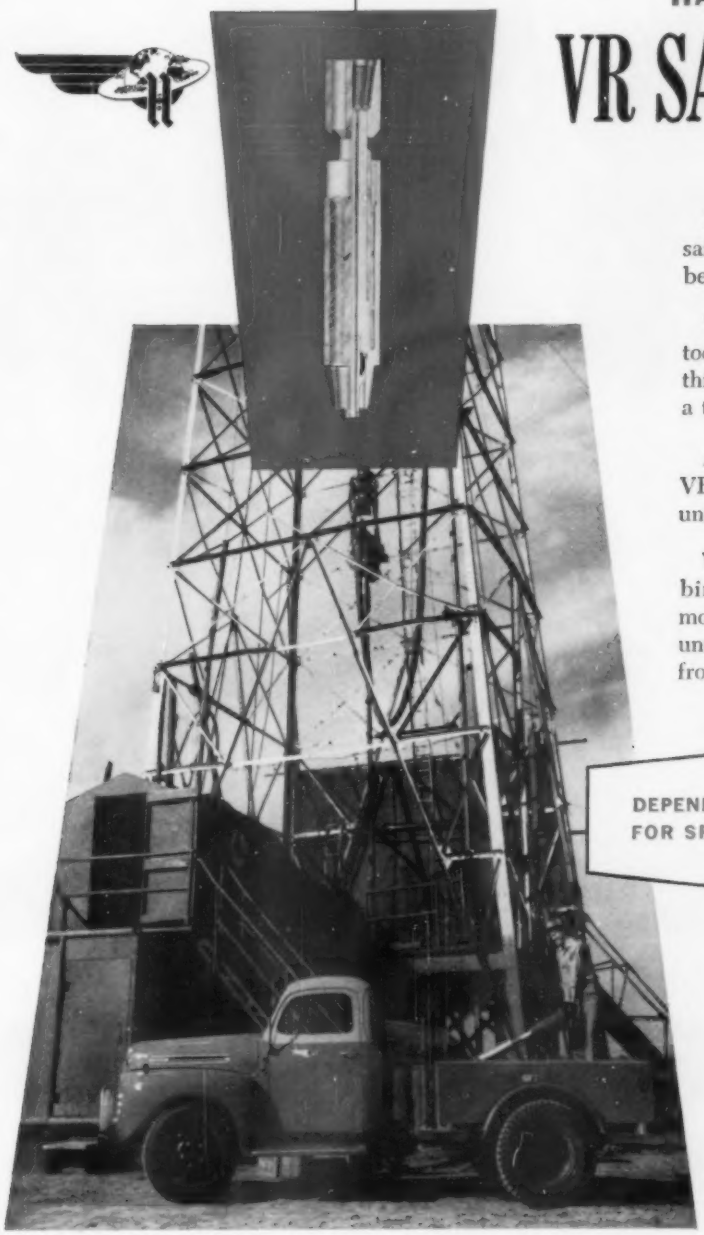
with HALLIBURTON

THE INDUSTRY'S RECOGNIZED LEADER
IN DRILL STEM TESTING

One of the secrets of a successful test is...

HALLIBURTON'S

VR SAFETY JOINT



Drill pipe and testing tools can be quickly and safely retrieved when either packer or anchor becomes stuck.

The VR Safety Joint prevents major loss of tools. The right-hand rotation used to release this joint's left-hand thread will not back off a tool joint.

A large area by-pass is incorporated in the VR Safety Joint to equalize pressure prior to unseating packer at completion of test.

When back-off is necessary, a simple combination of right-hand rotation and vertical movement of drill pipe allows the thread to be unscrewed easily and testing tools are removed from the well.

DEPEND ON HALLIBURTON TESTING FOR SPEED...SAFETY...ACCURACY

Ask for free Formation Testing Bulletin. Call your local office or write Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

HALLIBURTON

OIL WELL CEMENTING COMPANY, DUNCAN, OKLAHOMA

TESTING SERVICE

251 SERVICE CENTERS
JUST MINUTES AWAY FROM ANY RIG

Unified control produces peak

REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

performance

IN REPUBLIC CASING AND TUBING

In welded or seamless casing and tubing, you can count on top performance when you specify Republic. The reason is uniformity. Republic guards every factor that means service dependability, from raw ore to finished product. This unified control produces consistent strength, size and ductility throughout every joint.

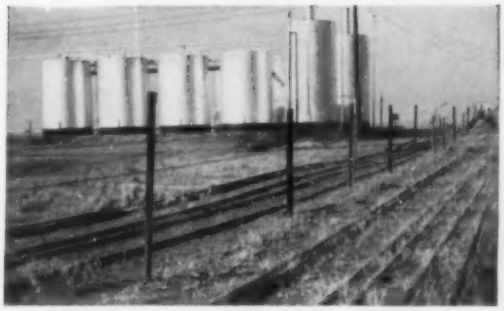
Take Republic Electric Weld Casing and Tubing, for example. Production starts with flat rolled steel. Careful control of width, thickness and surface assures that casing and tubing, cold formed and welded, from this steel, are uniform in wall thickness and concentricity—with flaw-free surfaces inside and out. Normalizing and cold-sizing provide uniform grain structure, high yield strength and true roundness.

The same unified control protects product superiority in Republic Seamless Casing and Tubing, from the initial piercing of special roll-forged Republic tube rounds, to final production and testing.

So, for peak-performance casing and tubing, electric weld or seamless, select Republic. Republic Electric Weld is produced in grades H-40 and J-55, sizes 2⅜" through 13⅜" O.D. Republic Seamless Casing and Tubing in grades J-55 and N-80, sizes 2⅜" through 9⅝" O.D. For complete information, contact your Republic Oil Country distributor, or mail coupon.

STEEL

and Steel Products



CORROSION-RESISTING PERFORMANCE of Republic's line of plastic pipe products provides the ideal answer to a host of oil field piping problems. Republic Semi-Rigid Butyrate and Kralastic Pipe are widely used for conveying sour crudes, salt water and raw gas; Republic Flexible Polyethylene Pipe is used for cold-water applications. All are light—easy to cut and join. For application information, send coupon.

PERFORMANCE OF GATHERING LINES, distribution lines and many other oil production applications requires top-quality pipe. Republic's Continuous Butt Weld Pipe fills the bill perfectly—providing easy threading, bending and welding. Available in sizes ⅛" through 4" nominal, in regular single or economical double-random lengths. Contact your Republic distributor for details or mail coupon.

CHRISTMAS-TREE PERFORMANCE can be no better than the strength of its fasteners permits. That's why so many manufacturers of high-pressure oil country equipment depend on Republic Alloy Studs. They provide the brute strength in body and threads required for tremendous holding power and long life. Send coupon for data on studs and fastener products.

REPUBLIC STEEL CORPORATION
Dept. C-3782
3112 East 45th St., Cleveland 27, Ohio

Please send information on:
- ☐ Electric Weld Casing and Tubing
- ☐ Seamless Casing and Tubing
- ☐ Alloy Steel Studs
- ☐ Continuous Butt Weld Pipe
- ☐ Plastic Pipe Products

Name_____ Title_____
Company_____
Address_____
City_____ Zone____ State_____

"Be sure those are WECO UNIONS"

It pays to ask for WECO by name at your supply store. For only then are you sure of getting the finest union made for perfect sealing and service.

Only then do you get the benefits of WECO'S precision ball and cone seat that holds a positive, leak-proof seal. You get fast, easy make-up and break-out — without damage to seat or threads. You get a wing nut that can take hammering without distortion . . . heavier wall sections in the sub ends that can take the toughest treatment on hook-up after hook-up.

Next time you get unions from your supply store — be sure to ask for WECO — and get the finest unions made.

U-14-56

WECO®

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of*
FOOD MACHINERY AND CHEMICAL CORPORATION

PESA

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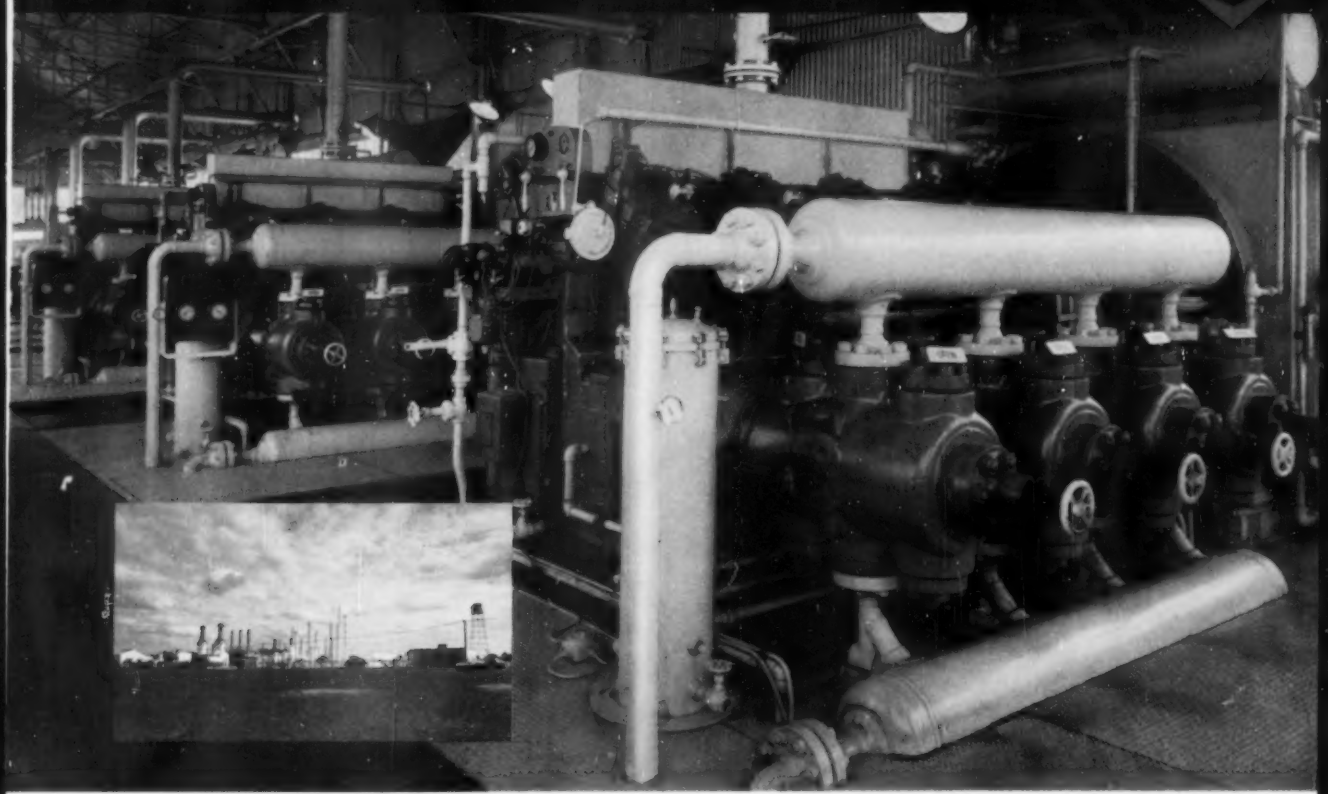
BEAIRD-INGERSOLL-RAND Packaged Compressor Plant



Arkansas Fuel Oil Corporation's Panola Gasoline plant equipped with three Beaird-Ingersoll-Rand 220 h.p. 8JVG packaged compressors. Units have Young radiators with lubricating oil coolers and gas after-coolers and all necessary controls for unattended operation. Other sizes 110 to 660 h.p.

Packaged Compressors provide—

FLEXIBLE OPERATION FOR LARGE GASOLINE PLANT

Arkansas Fuel Oil Corporation operates this large gasoline plant in the Panola Field just south of Carthage, Texas. Natural gas processed in the plant is picked up from 18 wells by three Beaird-Ingersoll-Rand 8JVG 220 h.p. packaged compressor units. Boosting 8 to 12 million cubic feet per day the units use one stage of compression to raise the gas from 550 psig input to 1100 psig.

To assure maximum flexibility and continuous operation, Arkansas Fuel Oil installed a number of packaged units rather than one large compressor of equal horsepower. Plant pressures and operations can be maintained, when necessary, by two of the units while the third is shut down for maintenance or repair. This permits plant production to be held to scheduled capacity at all times.

As wellhead pressures drop off the compressors can be changed on location to two-stage operation or additional units can be placed on the line. The operating flexibility of this multiple unit packaged compressor station will prove even more valuable as the field approaches depletion. When no longer needed the compressors can be transferred to other service as complete units with little or no change.

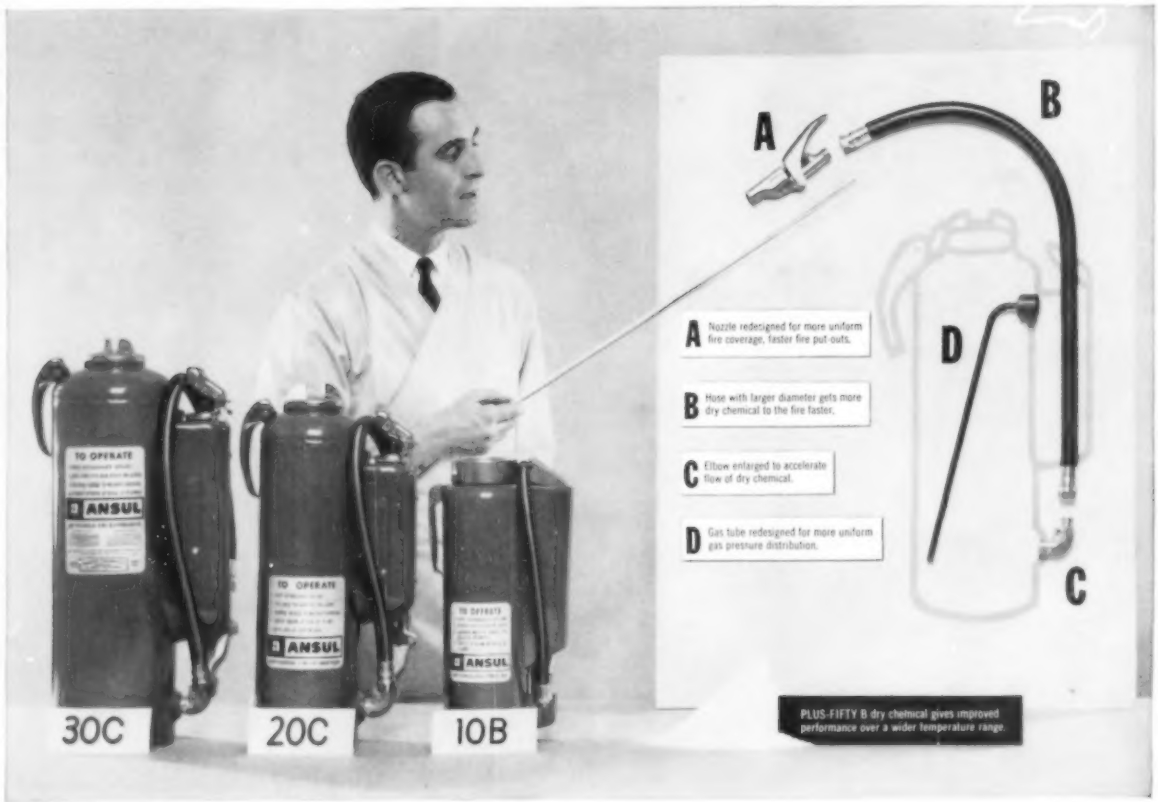
Let us show you how economically Beaird-Ingersoll-Rand packaged compressor plants can be added to your compressor station.

THE J. B. BEAIRD COMPANY, INC.
Shreveport, Louisiana

BEAIRD

LOWEST COST PER HORSEPOWER INSTALLED

SALES OFFICES: *Shreveport, New Orleans, Louisiana • Dallas, Houston, Corpus Christi and Midland, Texas • Tulsa, Oklahoma • Denver, Colorado • Los Angeles, California • Cie. Ingersoll-Rand, Paris, France • Caracas, Venezuela.*


A
B
C
D
A Nozzle redesigned for more uniform fire coverage, faster fire put-outs.
B Hose with larger diameter gets more dry chemical to the fire faster.
C Elbow enlarged to accelerate flow of dry chemical.
D Gas tube redesigned for more uniform gas pressure distribution.
PLUS-FIFTY B dry chemical gives improved performance over a wider temperature range.
30C
20C
10B
TO OPERATE
ANSUL

Important design improvements in these Ansul Extinguishers give you more fire fighting power at no increase in price. Three years of research and more than 2000 fire tests turned up some significant new information on dry chemical extinguishment. Ansul engineers were able to design these findings into three new extinguisher models, the 10B, 20C and 30C. Result, greatly increased fire fighting power. All Ansul equipment is backed by a five-year warranty. This is the best way we know to say Ansul fire extinguishers are the finest of their kind made anywhere.

ANSUL

The Ansul Chemical Co., Marinette, Wisconsin

Peppermint and spearmint oils must be kept pure to insure uniform flavor. That's the chief reason why I. P. Callison & Sons, Inc. of Seattle changed from coated steel drums to Benson Aluminum Drums for shipping these expensive oils. They believe, "It will only be a matter of time before the industry adopts aluminum as a standard for drum packaging".

Because aluminum resists corrosion there is no metal coating inside aluminum drums . . . nothing to flake off and contaminate the oils.

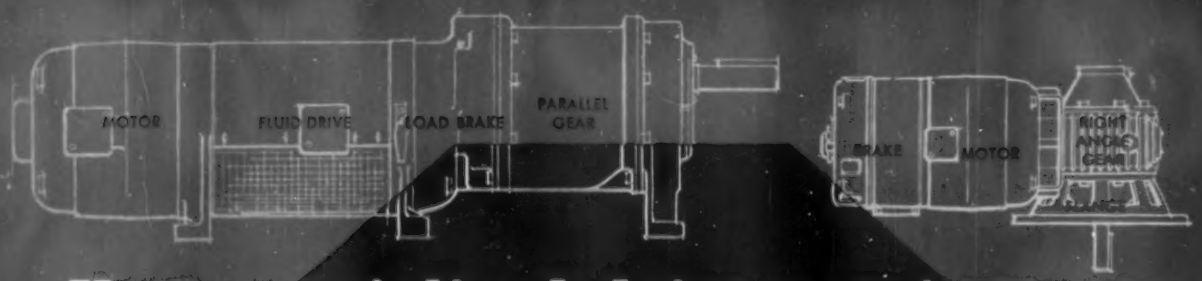
And aluminum drums offer economy. Aluminum's strength helps them withstand greater shock in handling and shipping. Aluminum's light. weight provides substantial freight savings. And aluminum drums are easier to clean for re-use.

For further information about proven benefits of Benson Aluminum Drums, contact the Reynolds office listed under "Aluminum" in classified telephone directories or write *Reynolds Metals Company, P. O. Box 1800-CR, Louisville 1, Kentucky.*

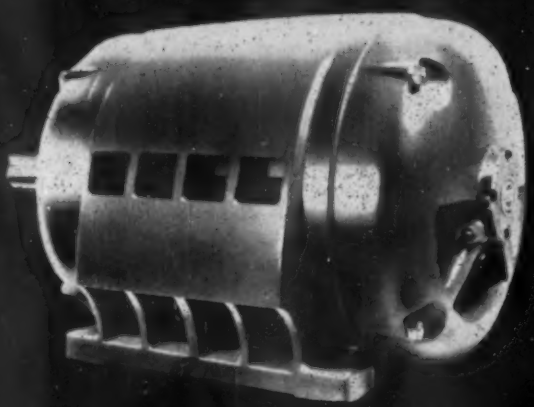
See "CIRCUS BOY", Reynolds exciting dramatic series, Sundays on NBC-TV.

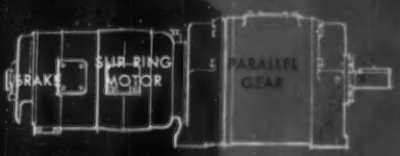
The Finest Products Made with Aluminum are made with REYNOLDS ALUMINUM

REYNOLDS ALUMINUM

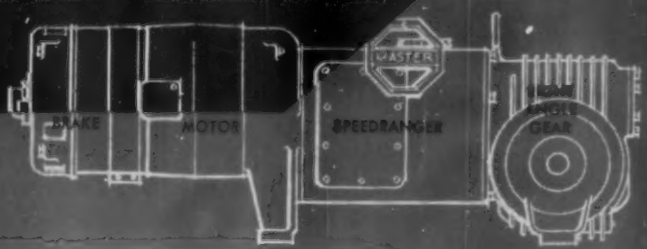


Your specialized drive requirements





Should meet their Master



Master Units Combine into Engineered, Customized Package Drives—Providing the Right Shaft Speed, the Right Construction Features, the Right Mounting. Why Put Up With Makeshift Assemblies?

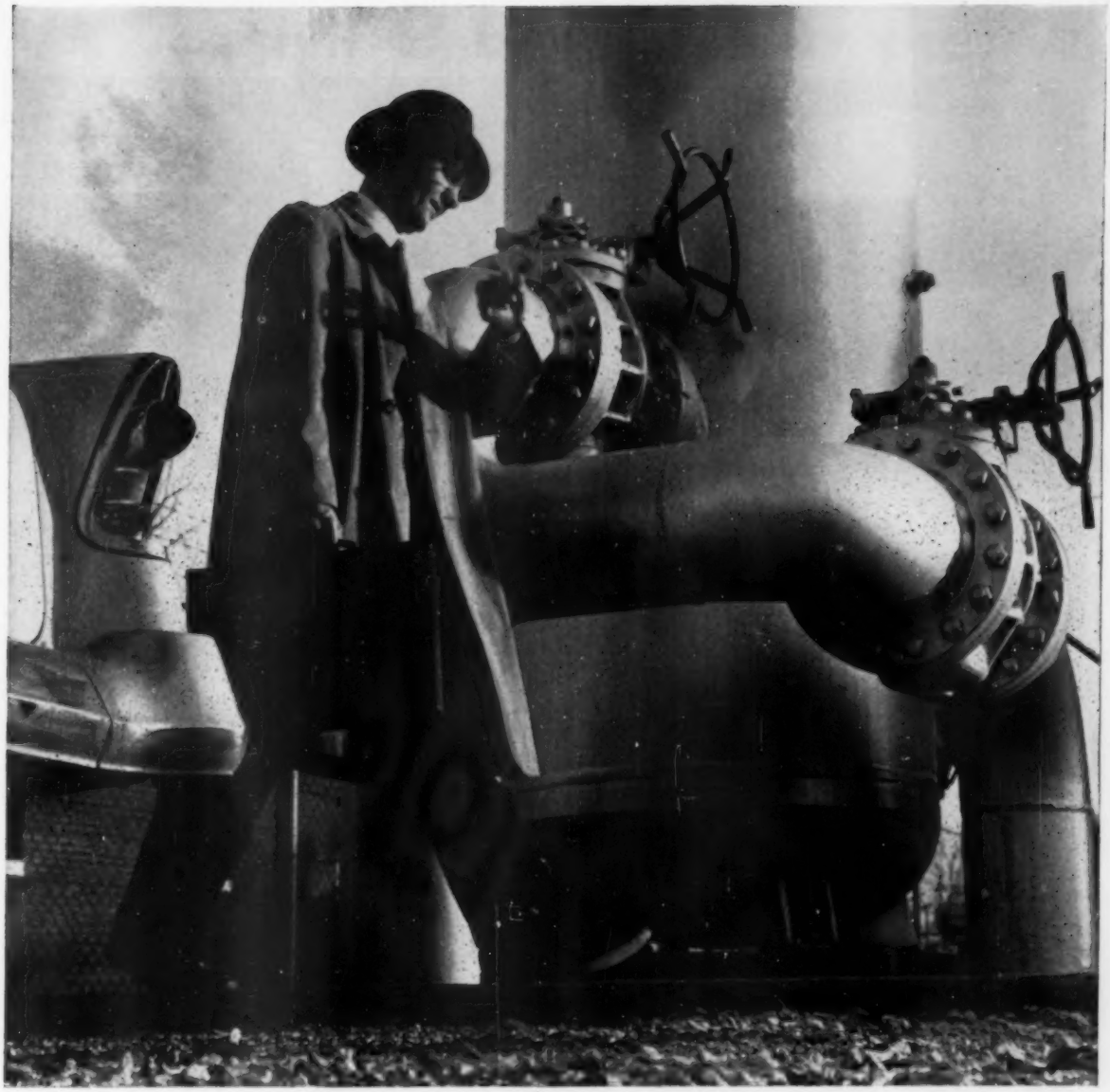
Engineers and Manufacturers of

Electric Motors	**⅛ to 400 H.P.**
Gearmotors	**⅛ to 125 H.P.**
Variable Speed Drives	**⅛ to 30 H.P.**
Unibrake Motors	**⅛ to 150 H.P.**
Fluid Drive Motors	**½ to 15 H.P.**

Alternating current motors, direct current motors, generators . . . open, enclosed, explosion proof . . . with 5 types of gear reducers . . . with electric brakes . . . with mechanical or electronic variable speed units . . . with fluid drives . . . Master has them all and so can be completely impartial in helping to select the one best drive for you.

MASTER ELECTRIC MOTORS

THE MASTER ELECTRIC COMPANY, Dayton 1, Ohio



The answer may be in the bag

(Dow tech service serves as a short cut in dehydration problems)

"Time is money," the saying goes. And where time is to be saved in solving gas dehydration problems, you're likely to find a Dow tech service man armed with facts.

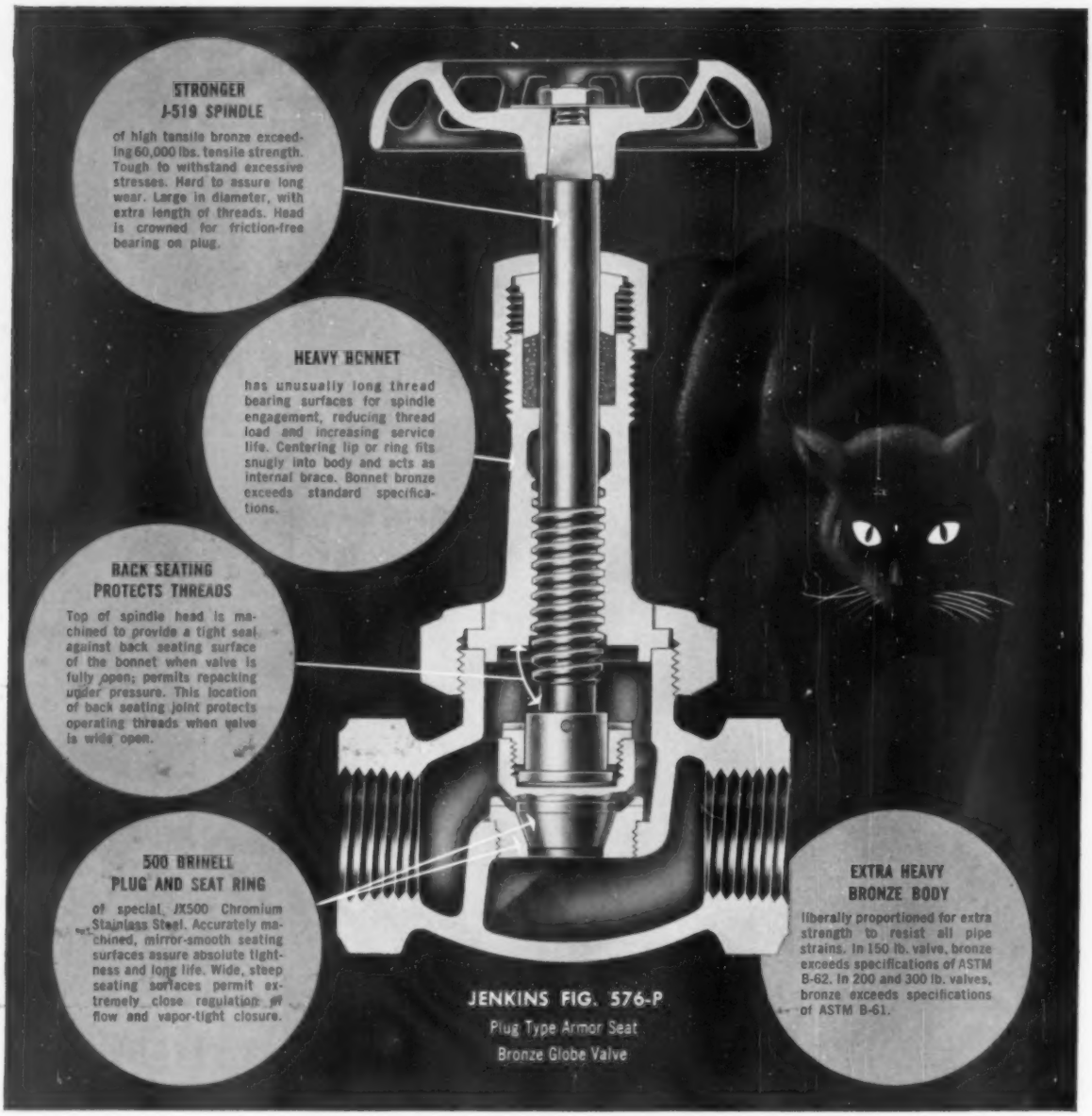
His experience on the use of glycols—and ethanolamines—often shows the short route to the answer. Yet his is a divided responsibility that works for your good. When our technicians are not in the field giving on-the-spot help, they're back in our lab analyzing samples with up-to-date equipment.

Unaccountable losses may be causing you to ask yourself, "Is my process as efficient as possible? Am I getting the most for my glycol dollar?"

Certainly, you have the know-how to find the answers yourself. But with Dow tech service on your side, trial and error are minimized. You often find the solution as near as one of our representative's carrying case. THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. GD813K-1.

YOU CAN DEPEND ON DOW

Where valves need 9 lives...


STRONGER
J-519 SPINDLE
of high tensile bronze exceeding 60,000 lbs. tensile strength. Tough to withstand excessive stresses. Hard to assure long wear. Large in diameter, with extra length of threads. Head is crowned for friction-free bearing on plug.
HEAVY BONNET
has unusually long thread bearing surfaces for spindle engagement, reducing thread load and increasing service life. Centering lip or ring fits snugly into body and acts as internal brace. Bonnet bronze exceeds standard specifications.
BACK SEATING
PROTECTS THREADS
Top of spindle head is machined to provide a tight seal against back seating surface of the bonnet when valve is fully open; permits repacking under pressure. This location of back seating joint protects operating threads when valve is wide open.
500 BRINELL
PLUG AND SEAT RING
of special JX500 Chromium Stainless Steel. Accurately machined, mirror-smooth seating surfaces assure absolute tightness and long life. Wide, steep seating surfaces permit extremely close regulation of flow and vapor-tight closure.
EXTRA HEAVY
BRONZE BODY
liberally proportioned for extra strength to resist all pipe strains. In 150 lb. valve, bronze exceeds specifications of ASTM B-62. In 200 and 300 lb. valves, bronze exceeds specifications of ASTM B-61.
JENKINS FIG. 576-P
Plug Type Armor Seat
Bronze Globe Valve

Install this JENKINS...made to defeat valve-killers

HERE are just five of the eighteen ways by which Jenkins Plug Type Valves have been engineered for maximum wear in valve-killing services. For any close-control steam service like drains, bypass lines, drips, blowoff, throttling, bleeders . . .

Or where abrasion, entrapped pipe chips, scale or rust tubercles are a problem . . .

You'll cut maintenance and replacement costs by specifying *"Jenkins Plug Type, with the 500 Brinell Stainless Steel Armor Seat"*. In the Jenkins Catalog are 150 lb., 200 lb. and 300 lb., Globe and Angle, screwed or flanged end valves in a full range of sizes. And, they are available quickly from local distributors' stocks.

WRITE us, or ask your Jenkins distributor for descriptive folder No. 202-A. Jenkins Bros., 100 Park Avenue, New York 17.

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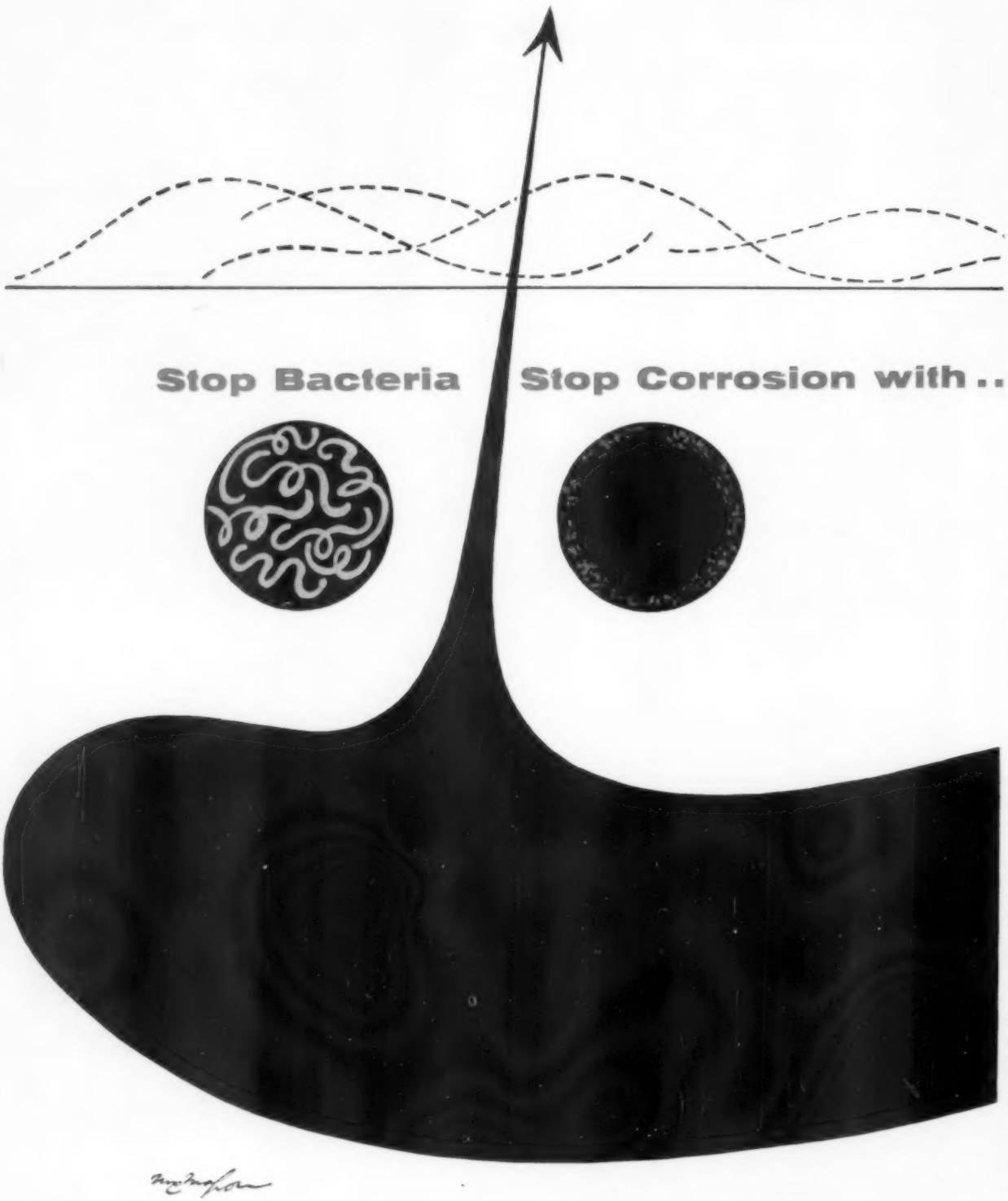
Stop Bacteria
Stop Corrosion with ..

Reports from engineers in the field show: Armour polar organic chemicals give 99.5% corrosion protection, and *complete* bacteria control—in concentrations as low as 6 ppm!

This remarkable record of success is a direct result of polar organic ability to be adsorbed continuously on metallic surfaces, forming a durable barrier against corrosive attack.

Equally important, they also adsorb on the surface of micro-organisms, disrupting the metabolic processes—particularly on the sulfate reducers, pseudomonas, iron and sulfur-forming types.

By using these Armour chemicals, your injection rates and pressures stay constant. Your equipment lasts longer.

Armour makes a series of polar organic inhibitors designed to solve specific problems. Look below for one to help you.

Armac® CD-50 (Distilled coco amine acetate salt, 50% active). A corrosion inhibitor-bactericide for water systems, this chemical has been proved effective in high brines or fresh water systems.

Duomeen® CD-50 (Distilled coco aliphatic diamine, 50% active). An extremely effective bactericide, but also an excellent corrosion inhibitor.

Duomeen CDA-50 (Distilled coco aliphatic diamine adipate salt, 50% active). An excellent bactericide and corrosion inhibitor that has found application in systems where carbon dioxide and oxygen corrosion are a problem.

Arquad® T-2C (Mixed monoalkyl and dialkyl quaternary ammonium chloride). A corrosion inhibitor and bactericide especially effective in low brines and fresh water systems.

Duomeen T (Tallow aliphatic diamine). An effective intermediate chemical for those who desire to formulate their own corrosion inhibitors or bactericides.

Duomeen TDO-50 (Liquid) (Tallow aliphatic diamine dioleate, 50% active). An easy to use, oil soluble, water dispersible down-the-hole corrosion inhibitor also being utilized to inhibit corrosion in salt water disposal systems and in producing wells.

Duomeen TDO (Fluid paste) (Tallow aliphatic diamine di-oleate). 100% active, oil soluble corrosion inhibitor.

Armour Chemicals Solve Refining Problems

Armour's line of polar cationic surface-active agents are being widely used in refineries to solve both operational and product problems.

The Armeens® and Duomeens® are typical of the Armour cationics that have resulted from laboratory and field evaluations. These materials and their derivatives are used in:

- *Controlling corrosion in processing equipment and finished product storage.*
- *Improving wear properties and acting as acid scavengers in lube oils.*
- *Inhibiting or solubilizing sludge formation in refinery products. . . . Stabilizing color . . . Improving filterability . . . Preventing fouling in equipment.*

For application information, product data, samples and treatment procedures, mail the coupon below.

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☐ Send me booklet "Armour Organics For Increased Oil Production."

☐ Samples of _____ (fill in chemical desired)

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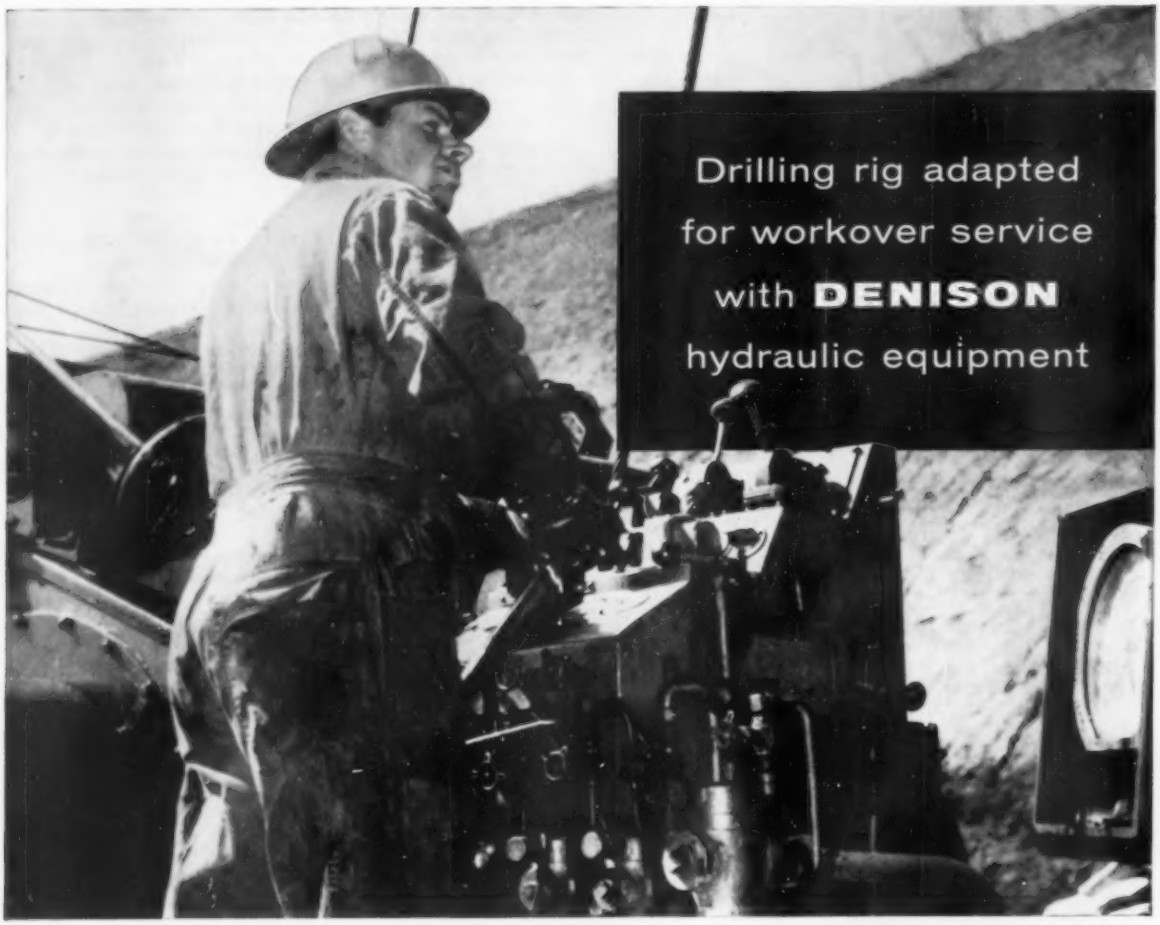
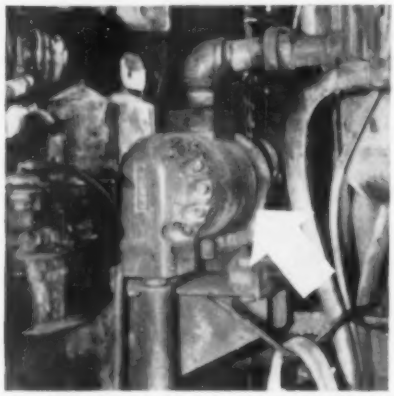


...prevents lost tools, increases production speed



One of the Denison 2000 psi vane-type hydraulic pumps used to power this effective adaptation of a drilling rig.

A drilling rig, adapted for workover service by the Harris Production Service Co., Long Beach, California, is another example of how Denison hydraulic equipment is helping to speed oil well drilling.

The rig consists of a 96-foot telescoping mast with a center extension ram and two side raising rams. The rig also contains a hydraulically driven rotary table, powered by a Denison vane-type fluid motor. A separate Denison vane-type hydraulic pump drives the fluid motor.

Rig-up time is kept to a minimum by speedily raising and extending the mast and drilling time is decreased by obtaining perfect torque control on the drill pipe through the rotary table drive. Torque control also prevents lost tools.

Three Denison vane-type pumps supply hydraulic oil at 2000 psi to the rams or to the rotary table. Ram speeds and rotary speeds are easily governed by selecting at will one, two or three pumps.

Let a Denison representative demonstrate the many benefits Denison hydraulic systems offer oil field operations. Write him today. Denison Engineering Division, American Brake Shoe Co., 1176 Dublin Road, Columbus 16, Ohio. Branch offices at: 2501 Bartlett St., Houston 6, Texas; 4714 E. 22 Place, Tulsa, Oklahoma; 565 North Prairie Avenue, Hawthorne, California.

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Unusually accurate bore due to "Know How" and advanced machining techniques.

Joints are "Hob Cut" to eliminate human error.

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Each heat of steel checked for quality by separate test specimens.

High physicals insure inherent strength.

BAASH-ROSS makes Kellys in all sizes—all designs (square, hexagon and octagon) and all lengths... plus incorporating the most advanced construction and metallurgical features. No effort is spared to insure you that a B-R Kelly is the very best that money can buy.

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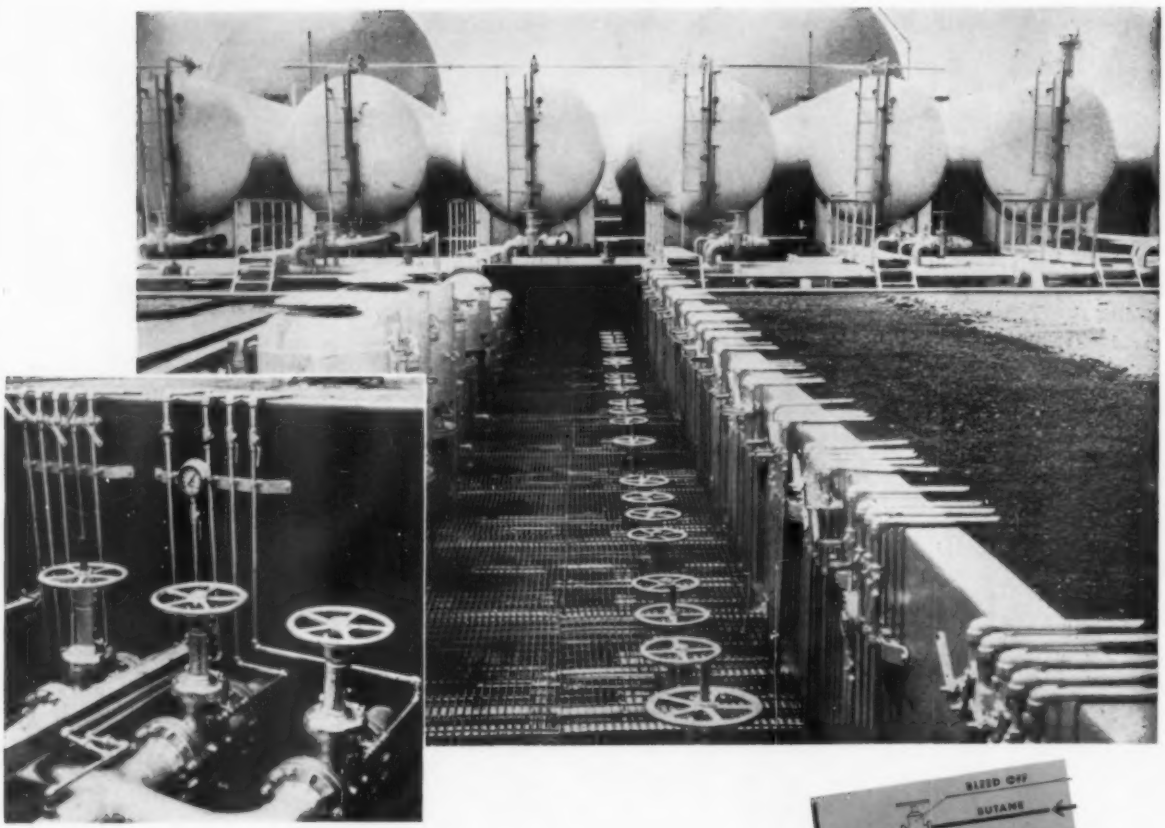
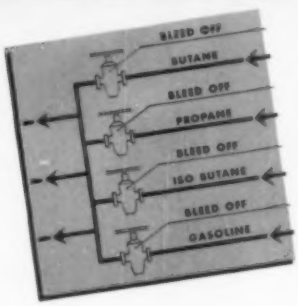
For further information write P.O. Box 1348, Houston 1, Texas or see The Composite Catalog.





A SINGLE W-K-M VALVE PROVIDES DOUBLE BLOCK AND BLEED PROTECTION

W-K-M non-lubricated gate valves with parallel expanding gates and TEFLON* seats seal vapor-tight on both the upstream and downstream seats, regardless of the direction of pressure. This provides the same protection as two conventional valves in a double block and bleed hookup. As the illustration above shows, the bleed line is attached to the body through a tapped opening, thus making it possible to bleed the body completely while holding securely a different gaseous or liquid product on each side of the valve. In addition, the stem on W-K-M rising stem valves is out of the body—to permit lubrication of the threads for easier opening and closing. The valve stem also serves as an "open"—"closed" indicator.

When you use W-K-M valves in such installations you save from ⅓ to ½ in valve costs and also save in piping and hookup time; in operation there is only one valve to handle instead of two.

Before you plan your next manifold, investigate W-K-M valves. They provide the most economical and efficient means of protecting your products from contamination.

*DUPONT TRADE NAME

560

W-K-M

DIVISION OF acf INDUSTRIES INCORPORATED

PLANT: MISSOURI CITY, TEXAS

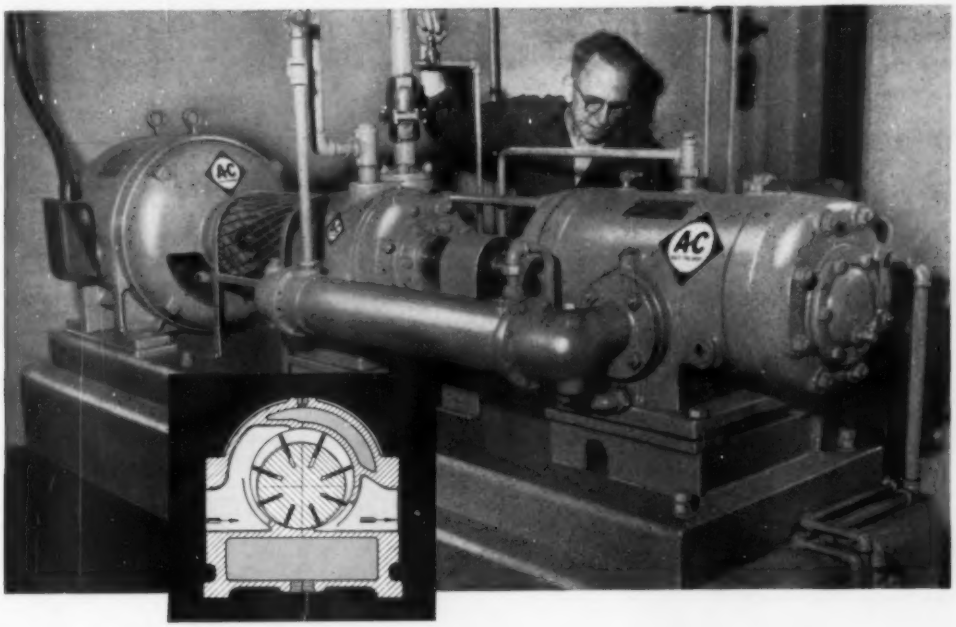
MAILING ADDRESS: P. O. BOX 2117, HOUSTON, TEXAS

MANUFACTURERS OF

W-K-M	acf	KEY
THROUGH-CONDUIT GATE VALVES	LUBRICATED PLUG VALVES	RETURN BENDS AND FITTINGS

RO-FLO

Compressors cut vibration . . . eliminate wear and tear



Low maintenance is one of 4 advantages

ROTARY motion and fewer parts reduce maintenance costs to a minimum. Lack of vibration and shock, plus the absence of reciprocating parts — pistons, valves, connecting rods — eliminates major causes of trouble.

Other advantages are:

Constant efficiency — During operation the sliding vanes of the rotor press outward against the cylinder wall to form air cells (as shown in drawing). The rotating force holds vanes tightly against the cylinder wall under all conditions, and air cell size, air flow, and efficiency always remain constant.

Compactness — No extra weight or size needed to dampen vibration.

Low-cost foundations — Smooth operation eliminates need for heavy, costly foundations. Small units are bolted directly to floor . . . large units need only a simple slab.

Many Types and Sizes

Single-stage units for pressures to 50 pounds gauge, and volumes from 42 to 3245 cfm. Two-stage units for 250 to 1800 cfm at pressures from 60 to 125 pounds gauge.

Single and two-stage vacuum pumps for vacuums to 0.3 inch mercury absolute from 22 to 5950 cfm.

For Information — Call your nearby A-C office or write for Bulletin 16B8244 (two-stage) and 16B-8126 (single-stage). Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

Ro-Flo is an Allis-Chalmers trademark

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-5354

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PETROLEUM ELECTRIC POWER ASSOCIATION
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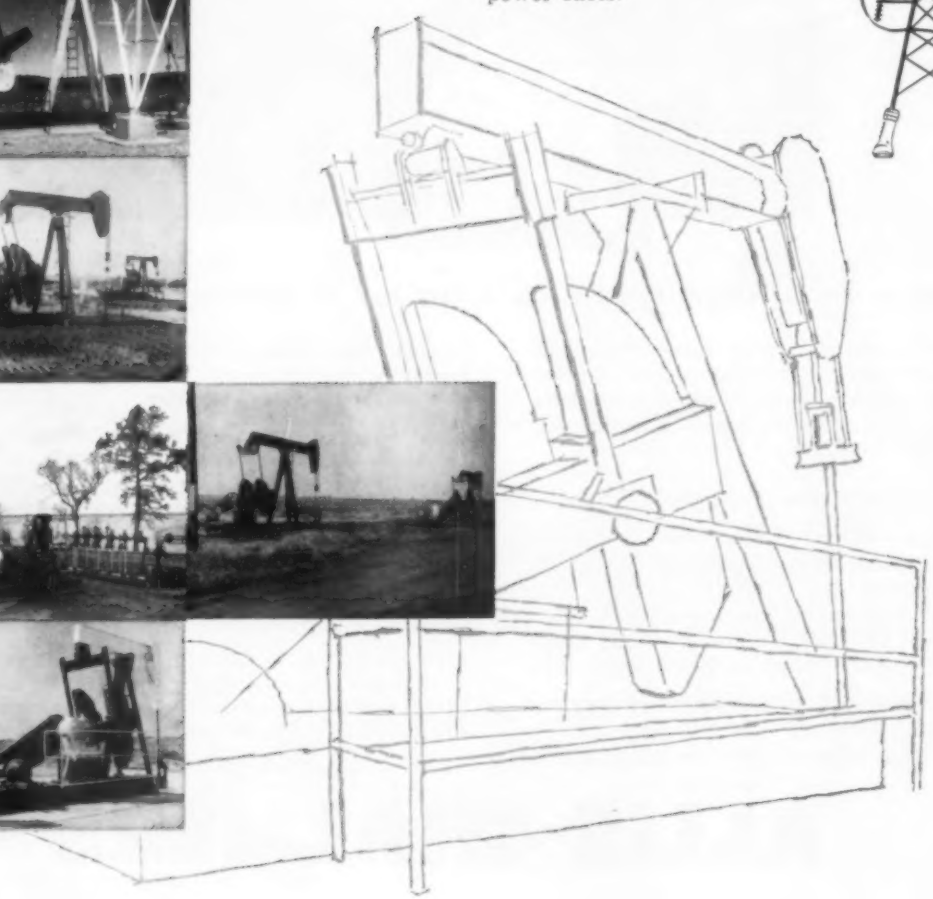
Call your nearest Electric Utility Company for power facts.



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The benefits of America's astounding chemical progress have a happy faculty for getting around. Say you manufacture, assemble, market an industrial or consumer product. From raw materials to finished item, an infinite variety of versatile chemicals speed processing, reduce costs, upgrade quality, enhance saleability. Yearly, break-throughs that come in chemical research and technology launch entirely new businesses or bring fresh vigor to old ones.

Then there's you, the consumer . . . rich—through chemicals—in health, food, housing, furnishings, clothing, and in many other added things that make living today easier, more convenient and enjoyable.

Columbia-Southern invites to your attention the current observance of the fourth annual Chemical Progress Week. When you create . . . when you consume . . . chemical and allied products are involved.

CHEMICAL PROGRESS WEEK-APRIL 8-12

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IN CANADA: Standard Chemical Limited and its Commercial Chemicals Division

Step up safety, performance and service life with

Vogt

Rugged Vogt Drop Forged Steel Gauge Cocks on this Natural Gasoline Storage Tank at Warren Petroleum Corporation's San Pedro California Terminal, are unsurpassed for safety to contents and to plant personnel. If a gauge cock glass should be accidentally broken, balls in the gauge cocks would automatically shut off the liquid until repairs were made.

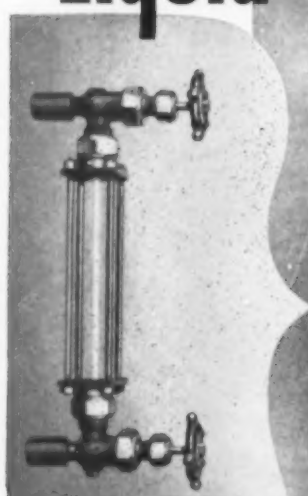
Reliable, trouble-free, outdoor operation year after year in exacting services of this kind is yours when you install Vogt Drop Forged Steel Liquid Level Gauges.

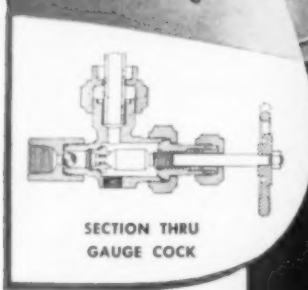
HENRY VOGT MACHINE CO., P. O. BOX 1918, LOUISVILLE 1, KY.

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Philadelphia, St. Louis, Charleston, W. Va., Cincinnati

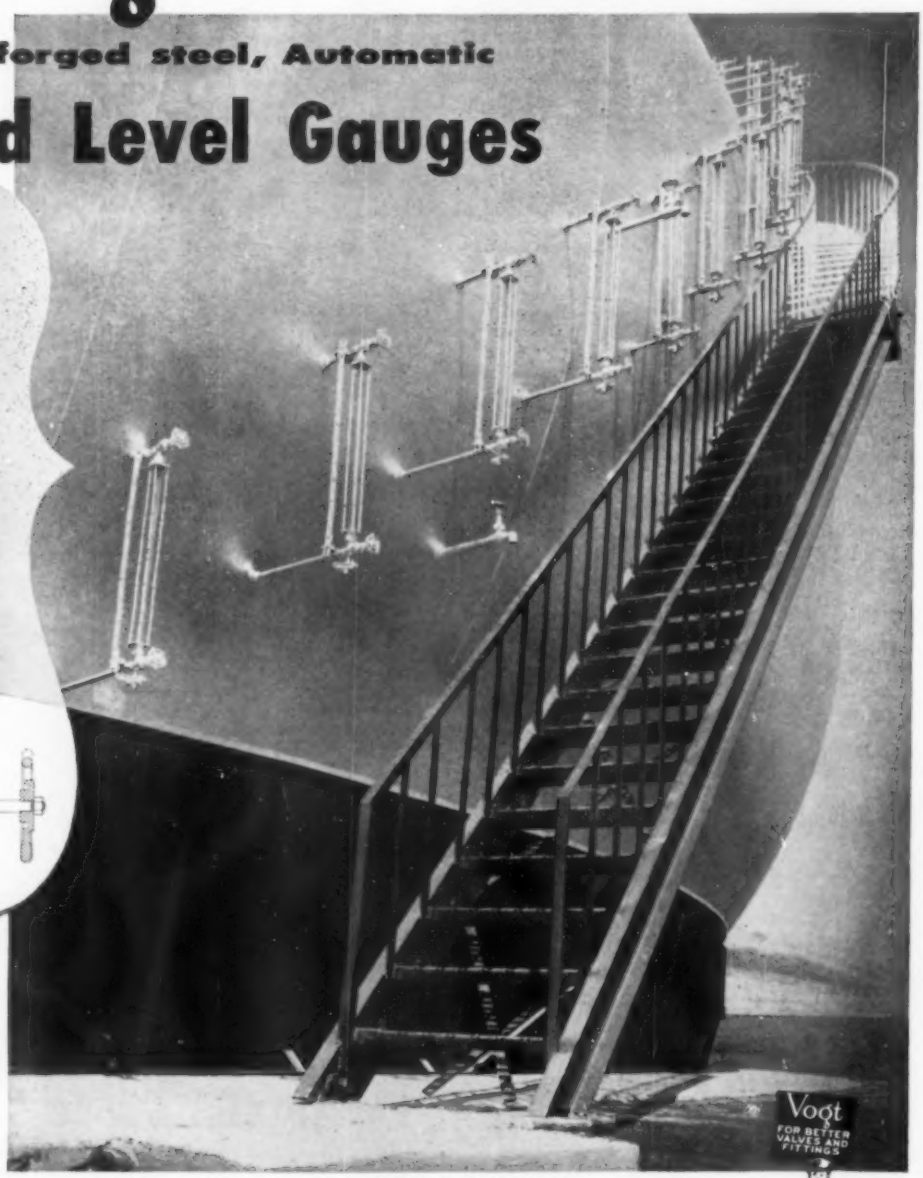
Drop forged steel, Automatic

Liquid Level Gauges





SECTION THRU GAUGE COCK



See Catalog F-9 for complete data on gauge cocks, trims, and gauge glasses for specific operating conditions or write Dept. 24A-FO.

OTHER VOGT PRODUCTS

Drop Forged Steel Valves, Fittings, and Flanges • Petroleum Refinery and Chemical Plant Equipment • Steam Generators • Heat Exchangers • Ice Making and Refrigerating Equipment.

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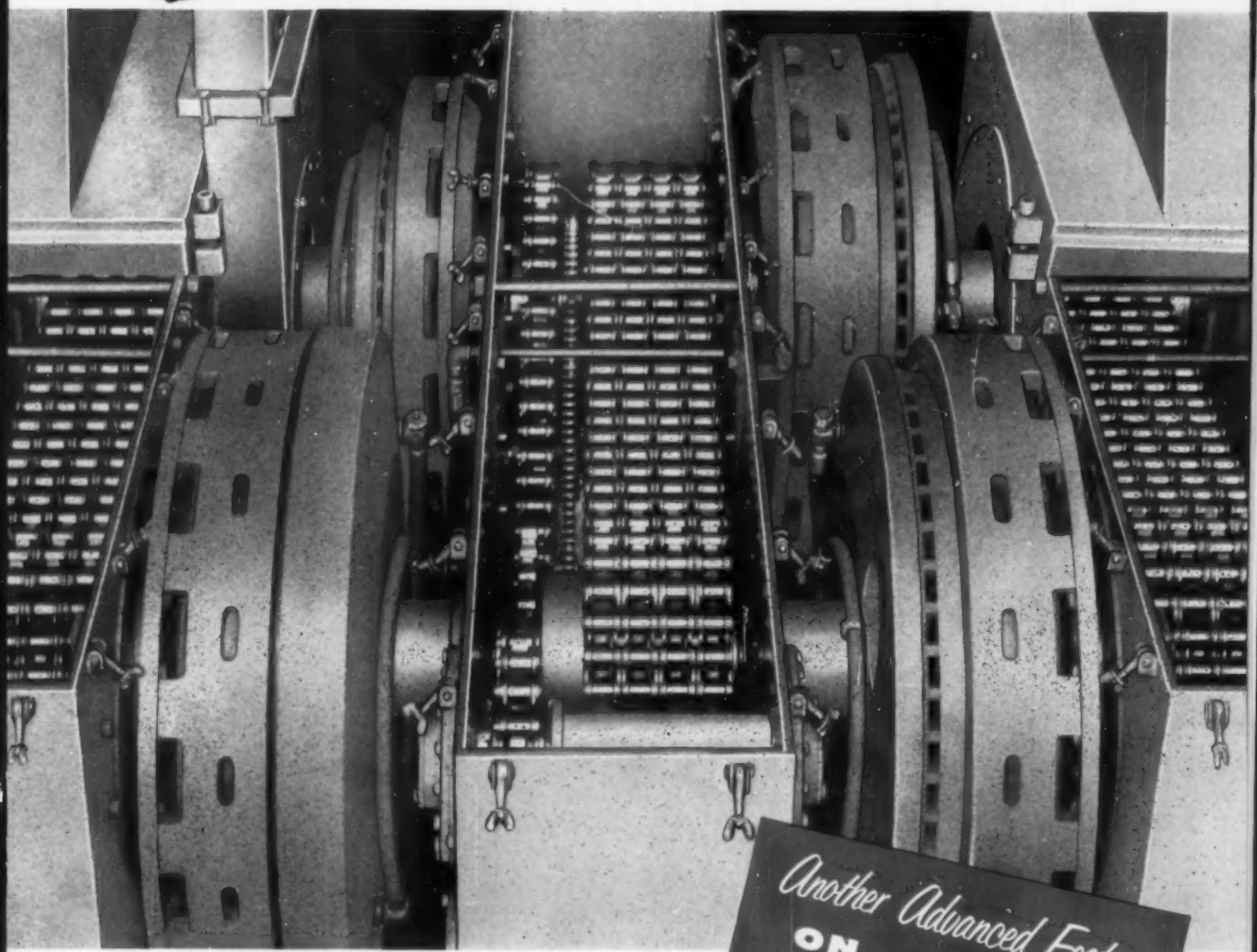
"Jet Age" Rig Performance



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Only Wilson has engineered and is producing rigs with advanced JET AGE PERFORMANCE! Each is designed around the world's newest, greatest, and most advanced transmission. A transmission as delicate as the finest jeweled watch, but as rugged and reliable as "Big Ben." Four great Air-Tube Disc clutches in this chain drive transmission mean that Wilson Super Rigs will *out perform any other rigs of comparable size . . . and at smoother, faster speeds!* Never an outmoded rig made over . . . Wilson Rigs are ALWAYS NEWEST . . . with the most advanced engineering throughout. Write for our New Catalog No. 257.

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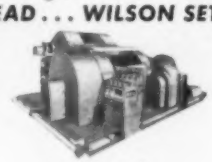
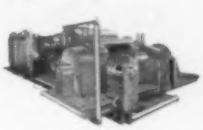
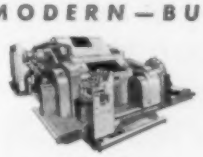
Super Titan "66"
22,000 Ft.—4½" Drill Pipe
25,000 Ft.—3½" Drill Pipe



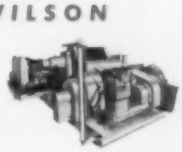
Super Titan "56"
15,000 Ft.—4½" Drill Pipe
19,000 Ft.—3½" Drill Pipe



Super Atlas
11,000 Ft.—4½" Drill Pipe
13,000 Ft.—3½" Drill Pipe



Super Giant
9,000 Ft.—4½" Drill Pipe
11,000 Ft.—3½" Drill Pipe

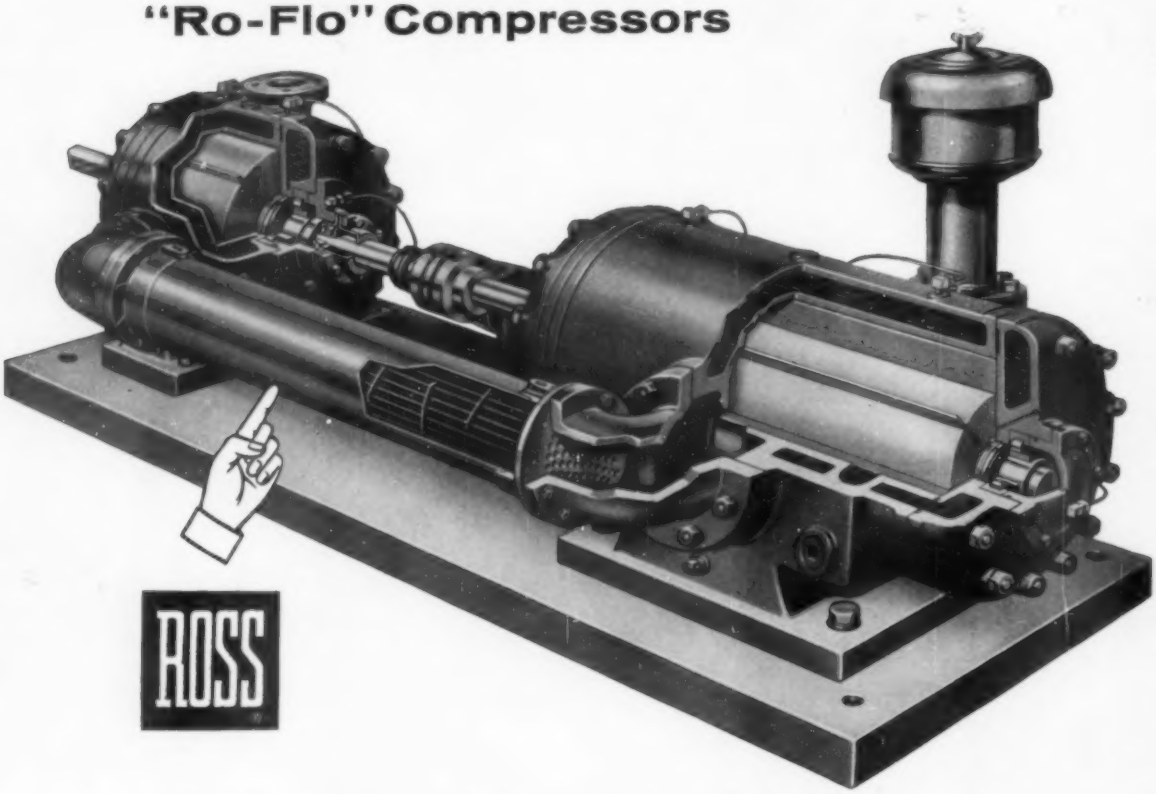


Super Mogul
7,500 Ft.—4½" Drill Pipe
8,500 Ft.—3½" Drill Pipe

THE MOST MODERN AND COMPLETE LINE OF DRILLING RIGS IN ALL THE WORLD

ROSS INTERCOOLERS

boost thru-put capacity of "Ro-Flo" Compressors



With volumes ranging from 250 to 1800 cfm and pressures from 60 to 125 psig, smooth running two-stage "Ro-Flo" compressors manufactured by Allis-Chalmers(like the one shown) are used for shop air, gas handling and drilling applications.

To insure peak performance, a Ross Intercooler is furnished as an integral component between the low and high pressure stages. First stage compression heat is removed from the air or gas, along with condensed moisture, before it enters the second stage cylinder. The result: Increased thru-put capacity and lower discharge temperatures.

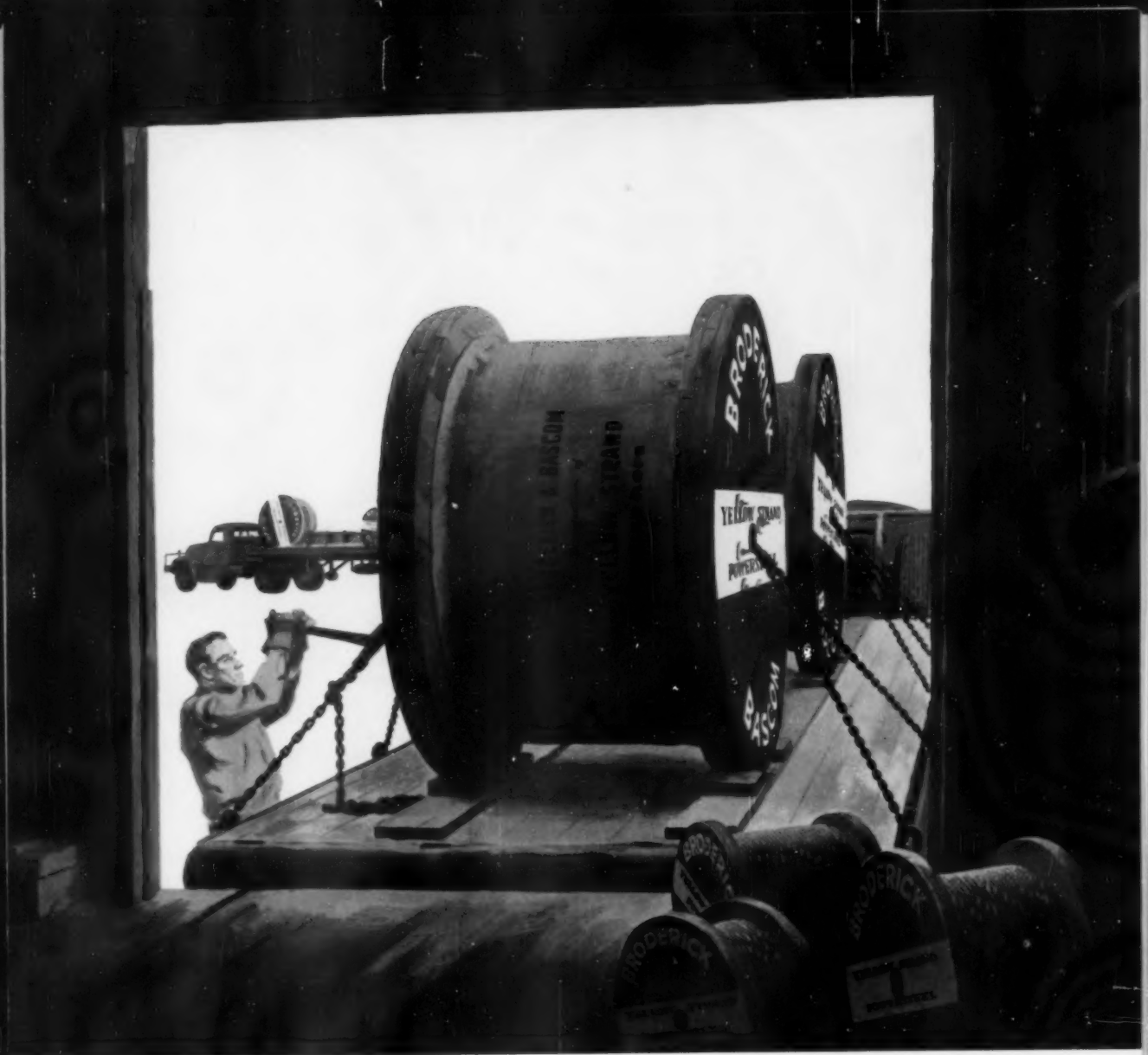
Rated first for their heat transfer efficiency and ruggedness, Ross Cylinder-Mounted Intercoolers are widely preferred by compressor builders and users alike. The same holds true for Ross Aftercoolers, Lube Oil Coolers and Jacket Water Coolers. Available in a wide range of standardized designs, they are used to meet practically every compressor cooling requirement.

For further information on the many types of compressors served by Ross Exchangers, write Ross Heat Exchanger Division of American-Standard, Buffalo 5, N.Y. In Canada: American-Standard Products (Canada) Limited, Toronto 5, Ont.

INTERCOOLERS
AFTERCOOLERS
LUBE OIL COOLERS
JACKET WATER COOLERS

ROSS HEAT EXCHANGER

Division of AMERICAN - Standard



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"POWERSTEEL" . . . the rotary line to give you *longer, lower cost service* is now available at your convenient Continental-Emsco Store. Stocks are complete in all grades, sizes and constructions to take care of all your rope requirements.

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Representatives in All Principal Oil Fields of the World

There's a Green Triangle rotary hose for every application !

NEW YORK BELTING & PACKING CO. • founded 1846

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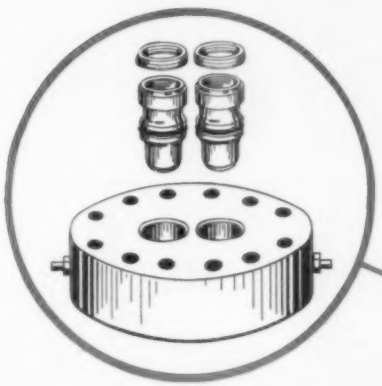
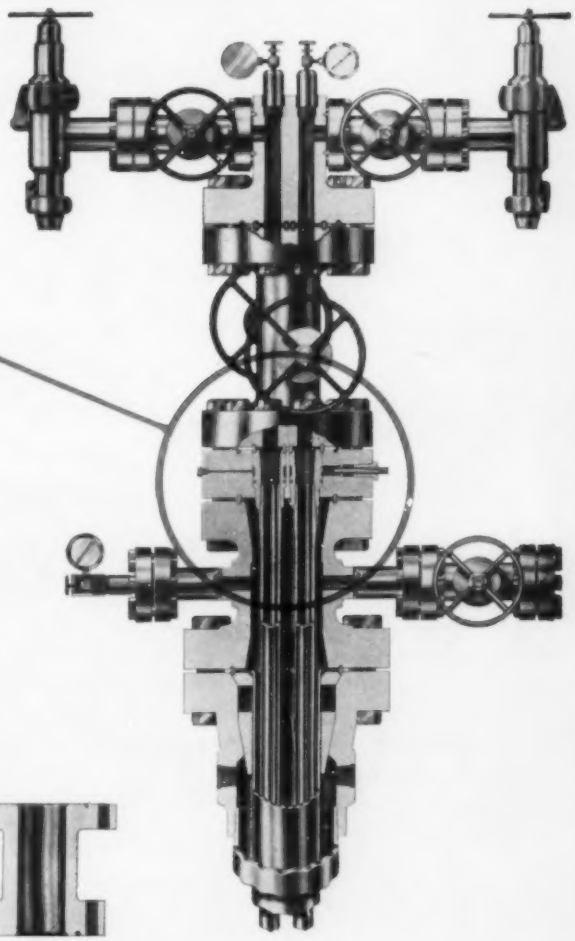
RECTOR Dual-String Hanger Flange

Outstanding Simplicity and Flexibility, plus the FAMOUS Rector Metal-to-Metal Seal





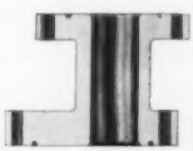
SIMPLICITY: The flange has two full opening tapered bores in which the strings are suspended by threaded mandrels. This eliminates mating and sealing two tubing hangers in a single, large bore. Each string can be suspended, temporarily sealed, and held down independently of the other assuring maximum ease of installation with complete control of well.

FLEXIBILITY: Regular 2" API upset tubing can be run or pulled through the bores in the flange.

METAL-to-METAL SEALS: Each mandrel is independently sealed by a metal seal ring in the groove at the junction of mandrel and flange. This metal-to-metal sealing arrangement also acts as a hold-down. "O" Rings on the mandrel provide a temporary seal during completion and permit testing the seal after Christmas Tree is installed. Mandrels are grooved for hold-down locking screws, which are optional in the flange.

- **Rector Dual-String Hanger Flanges are available in Nom 6 and Nom 8 sizes in any series. Mandrels are interchangeable.**

For maximum simplicity and flexibility of dual-string suspension, plus the metal-to-metal seal that never requires maintenance or replacement, specify a Rector Dual-String Hanger Flange in your dual completion Christmas Tree.



Off-Set Adapter Spool permits use of regular preventer equipment with alignment directly over each individual bore while running and pulling tubing. After first string is run, Adapter Spool can be rotated to center directly over the other bore.

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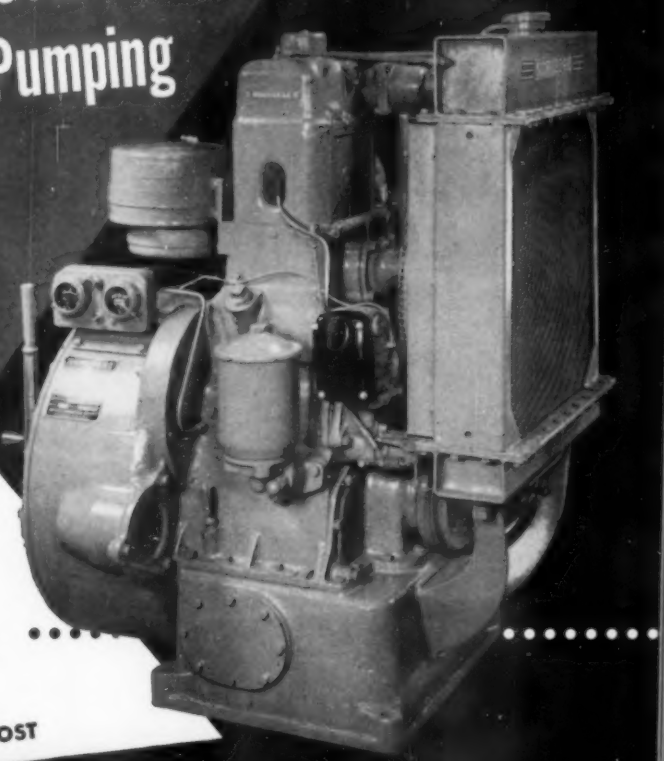
OVER 31,000 HOURS OF CONTINUOUS OPERATION WITHOUT AN OVERHAUL

. . . a typical Production Pumping record for



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Over 31,000 hours of continuous operation with the original rings, piston, liners, bearings and crankshaft still in place . . . this is typical of the service histories of many Nordberg Power Chief engines now on rugged round-the-clock production pumping schedules.

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These features alone mean more "money in the bank" when you use Power Chief Engines. Add to this the many "extras" that are included as standard equipment and you will see why you save by specifying "Power Chief".

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A new name in pumping units

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Before designing the new Aztec pumping unit, we studied the requirements of many oil producers. As a result, Aztec units combine *many important field-proven features* with the latest design principles developed through our own extensive manufacturing experience.

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Aztec units are available NOW in sizes up to 7,000 pounds API polished rod load capacity. Rapid expansion will soon make available a complete range of sizes of Aztec units. Ask your supply store for information and prices.

See the new Aztec pumping unit at your favorite supply store soon. Compare it, try it, and prove it's your best pumping unit buy.

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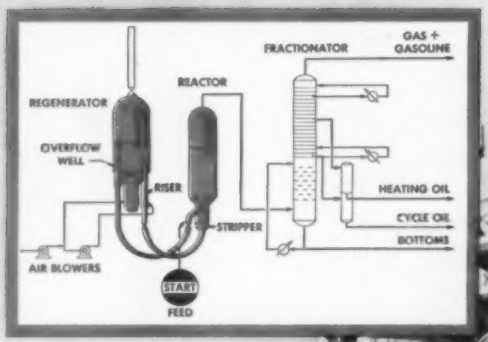

10,800 B/D LION OIL CO. DIVISION OF MONSANTO CHEMICAL CO. UNIT, EL DORADO, ARK.

MODEL IV CAN GIVE YOU FLUID CATALYTIC CRACKING AT LOWEST INVESTMENT COST

Esso Research and Engineering Company offers you *Model IV*, the simplest and most stable *Fluid Catalytic Cracking* process yet developed. The lower investment, maintenance and operating costs of the *Model IV Fluid Catalytic Cracker* are another achievement of the Esso Research program — 38 years of new process developments made available to refiners around the world.

A new compact catalyst transfer system with smaller-sized vessels lowers over-all height and uses far less structural steel. Slide valves are eliminated — inherent self-stability and easy recovery from upset result in long run lengths.

First *Model IV* unit on stream was erected under license in 1952. Twenty-four *Model IV's* have since gone on stream — more than half of their capacity under license. Nine more units are in the construction or planning stage. Flexible *Model IV Fluid Catalytic Cracking* can play an important part in helping you meet changing market demands. We would welcome your inquiry.

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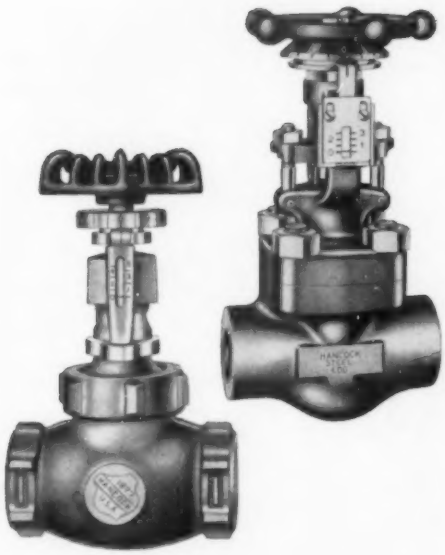
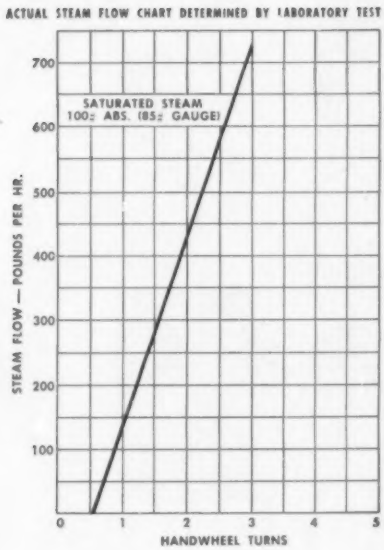
Your key to progress... an Esso Research process





HANCOCK "Flocontrol®" VALVES

- ✓ **Insure Uniform Quality Through Closer Control**
- ✓ **Save Steam and Fuel on Process Work**
- ✓ **Save Money by Cutting Maintenance**

Hancock "Flocontrol" Valves provide a 3-in-1 design that combines variable orifice, shut-off and index. The valve opening can be set to within one-tenth of a turn of the handwheel. The micrometer dial and pointer make it easy to duplicate any desired setting instantly.

Each valve has a scientifically designed V-port valve disc that insures proportional flow throughout the entire lift of the stem. Straight line flow with separate shut-off seating surface removed from the controlling V-ports eliminates the need for a separate shut-off valve.

Hancock "Flocontrol" Valves are available in Bronze and Steel to meet specific requirements. All are rugged valves, designed and constructed to provide the *economy of quality* so essential to assure top performance in the most demanding services.

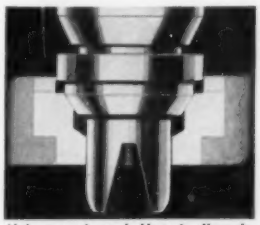
Hancock Bronze "Flocontrol" Valves. *Types:* Globe and Angle. *Sizes:* ¼" through 2". *Connections:* Screwed Ends. "500 Brinell" Stainless Steel Seats and Discs. 150# Series for all pressures up to 150 psi at 358° F. 300# Series for all pressures up to 300 psi at 550° F.

Hancock Forged Steel "Flocontrol" Valves. *Types:* Globe and Angle. Renewable Hard-Faced Stainless Steel Seats. "500 Brinell" Stainless Steel Discs. *Connections:* Screwed, Socket Weld and Flanged Ends. *Sizes:* Screwed and Socket Weld Valves—¼" through 2". Flanged Valves—½" through 2". *Screwed and Socket Weld Valves:* For all pressures up to 600 psi at 910° F. O.W.G.—2000 psi at 100° F. *Flanged Valves:* For all pressures up to 600 psi at 850° F. O.W.G.—1440 psi at 100° F.

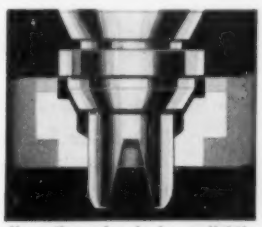
Hancock Cast Steel "Flocontrol" Valves. Globe Type with Screwed Bonnet. Renewable Stainless Steel Plug Seats and Discs. *Sizes:* 2½" and 3". *Connections:* Screwed and Flanged Ends. For all pressures up to 395 psi at 775° F. O.W.G. —720 psi at 100° F.

Hancock Cast Steel "Flocontrol" Valves. Globe type with Bolted Bonnet. Renewable Stainless Steel Plug Seats and Discs. *Sizes:* 2½", 3" and 4". *Connections:* Flanged Ends. 300# Series for all pressures up to 395 psi at 775° F. O.W.G.—720 psi at 100°F. 600# Series for all pressures up to 800 psi at 775° F. O.W.G.—1440 psi at 100° F.

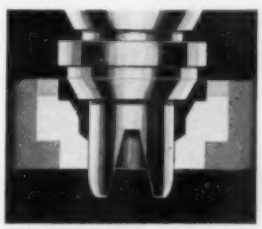
HANCOCK "FLOCONTROL" VALVES OPERATE LIKE THIS . . .



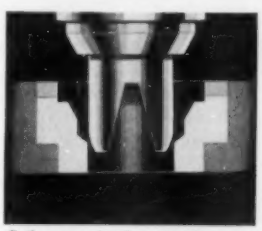
Valve seat and V-port disc in fully closed position. Pressure pushes upward under the disc. Note that the shut-off seating surface is completely removed and separate from the flow-controlling V-ports.



Here the valve is in a slightly opened position. The V-port disc is permitting a measured flow of the media.



This is the intermediate position. Note that the V-port disc now permits a proportionally greater flow of the media.



Fully opened valve provides maximum flow. The special micrometer dial and pointer permit any open position to be duplicated accurately.

YOUR INDUSTRIAL SUPPLY DISTRIBUTOR is as close as your telephone. Let him help you select the right Hancock "Flocontrol" Valves for your needs. You can depend on him for fast delivery from local stocks.

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

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A product of **MANNING, MAXWELL & MOORE, INC.** Watertown 72, Massachusetts

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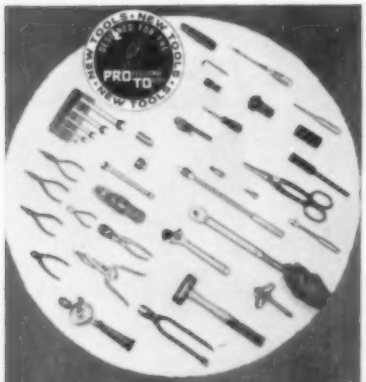

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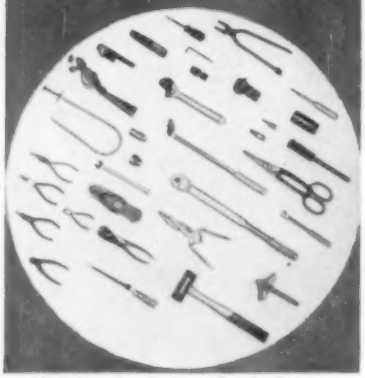

Joining the thousands of other proven standard and special tools are hundreds of *new* tools, developed to meet the exacting requirements of your job. With this extensive line you can build a complete matched set of guaranteed tools, getting time-saving designs, long service, and highest quality at the right price. Make your PROTO dealer your Tool Headquarters. Send 10¢ for catalog of entire line to **PROTO TOOLS**

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Forging Ahead Through Leadership Quality, Service and Understanding

They Say—

Earmarks of competition

"If the oil industry merited the charge of monopoly, there would be no such thing as a price war, no such thing as improvement of service stations, no such thing as competitive advertising and sales promotion materials, no such thing as research, no such thing as constant improvement of products, and no such thing as the development of new products. All of these things of which we see daily evidence everywhere about us are violently inconsistent with the definition and flavor of monopoly.

C. J. GUZZO

"I suggest that anyone who is curious about these things get in his car and drive a short distance in almost any community and study the service stations and their prices. Even though price similarity is the logical and ultimate result of hard competition, there are always venturesome dealers who are testing the drawing power of lower prices. You will see these things if you pause to observe.

"I say that these are not the conditions to be found in a monopolistic or non-competitive industry."

C. J. Guzzo, vice president, Gulf Oil Corp., in a speech before the Ohio Petroleum Marketers Association.

More on "Oil Hits Back!"

Dear Sir:

. . . This is one of the most brilliant and serviceable pieces of writing ever printed in your Journal—and I've been reading it for a very long time. . ."

G. Q. Porter
Sarasota, Fla.

Our confusing geology

Dear Sir:

As it so is, we are somewhat more than somewhat confused over "Pescadito," the little fish. The way this Ginther & Ginther hole is going now at around 8,000 ft., you may be correct in the "Big Yellow" of March 25, 1957, page 287. Por Favor!

"Eagle Ford, Buda and Del Rio undifferentiated shale from 12,850 to 13,300 ft.: Georgetown shale and limy

Quitting Time..?

. . . No sir; this ABI man has an important date. A little over an hour ago a drilling superintendent on a Pierce Junction workover called the Brine Service Company in Houston for 400 barrels of super-saturated, Ready-Made brine.

In about 20 minutes this ABI driver will have made his delivery and ABI will add another name to its rapidly growing list of satisfied customers. ABI realizes the importance of keeping appointments on time. When ABI says they'll provide three hour service anywhere along the Texas Gulf Coast, in Louisiana, Eastern New Mexico and West Texas, they mean exactly that. ABI knows time is a valuable commodity in the drilling business.

Call the ABI brine company nearest you and find out for yourself.

Associated Brine Industries

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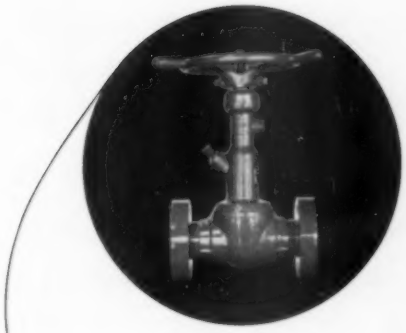
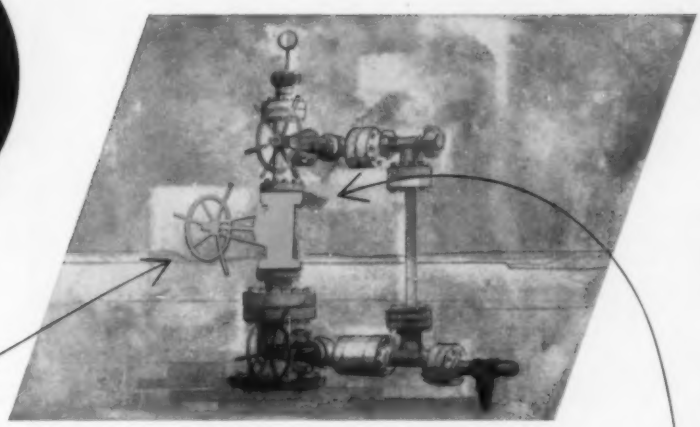
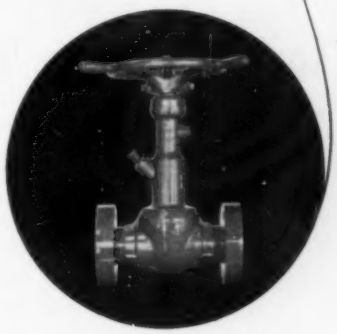
Brine Service Co.	Houston, Corpus Christi
Toland Brine Service, Inc.	Kermit, Tex.
The Brine Co.	Midland, Tex.; Hobbs, N. M.





why this valve should be replaced with an ORBIT VALVE...

This valve could easily be out on your lease right now. No matter where it is, this valve is a troublemaker and should be replaced — with an Orbit valve!



Orbit production valves have features that eliminate so much of the valve trouble ordinarily encountered. They are easy to operate and shut off. Stem packing is plastic with Teflon base, highly resistant to all liquids normally handled in the production of oil and gas. Trouble-free performance and low maintenance explains why so many men in the field always ask for Orbit valves.

You can get Orbit production valves any time from your favorite supply store or well head manufacturer.

ORBIT VALVES®

ORBIT VALVE COMPANY

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Where conditions in the oil fields are toughest — on mud pumps, steam hammers, high-pressure lubricators, and special hydraulic equipment — R/M Vee-Square® outperforms them all. It has positive nonyielding properties . . . assures automatic sealing . . . needs no sensitive gland adjustments . . . and permits unrestricted use of gland pressure.

Patented R/M Vee-Square has these special built-in features:

1. Gland pressure is absorbed by the solid square section. The packing can not roll or ride the rod.
2. Automatic sealing is assured by the V design.
3. Blow-by is prevented by the soft rubber cushion between the rings.

R/M VEE-SQUARE KEEPS NEW RODS NEW LONGER

For complete information on R/M Vee-Square, write today for booklet shown

R/M MAKES A COMPLETE LINE OF MECHANICAL PACKINGS—including Vee-Flex, Vee-Square, Universal Plastic, and "versi-pak"®; GASKET MATERIALS, "TEFLON"† PRODUCTS. SEE YOUR R/M DISTRIBUTOR.

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PACKING DIVISION, PASSAIC, N.J.
MECHANICAL PACKINGS AND GASKET MATERIALS

FACTORIES: Passaic, N.J.; Bridgeport, Conn.; Manheim, Pa.; Neenah, Wis.; No. Charleston, S.C.; Crawfordsville, Ind.; Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Mechanical Packings • Asbestos Textiles • Industrial Rubber • Engineered Plastics Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks Clutch Facings • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

shale *12,300* ft. to total depth of 13,-704 ft."

Verily, verily, geology is an inexact science.

R. R. Kirkpatrick
Laredo, Tex.

(Editor's note: The figure for top Georgetown obviously should have been 13,300 ft. Thanks to an alert reader.)

Kefauver vs. big business

"S-11 proposes to amend the Robinson-Patman Act so as to eliminate, or at least sharply limit, the right of a seller to meet 'in good faith' the lower price of a competitor. It specifies that a seller cannot lower his prices to meet competitive prices, unless he lowers his prices to all of his customers in an area.

". . . With one piece of legislation Senator Kefauver proposes to wipe out that magical element of our nation's success—competition. And in doing it he chooses to portray himself as the friend of the consumer, the little fellow, the small businessman, and the downtrodden. He becomes our crusading champion by fixing it so that every manufactured or processed item we buy has a fixed price—a fair-traded item.

"The object of this bill is to outlaw the businessman's right to compete vigorously and to make price decisions which might determine the success—or failure—of his business."

Donald I. Rogers, New York Herald-Tribune business and financial editor.

Indiana Standard on imports

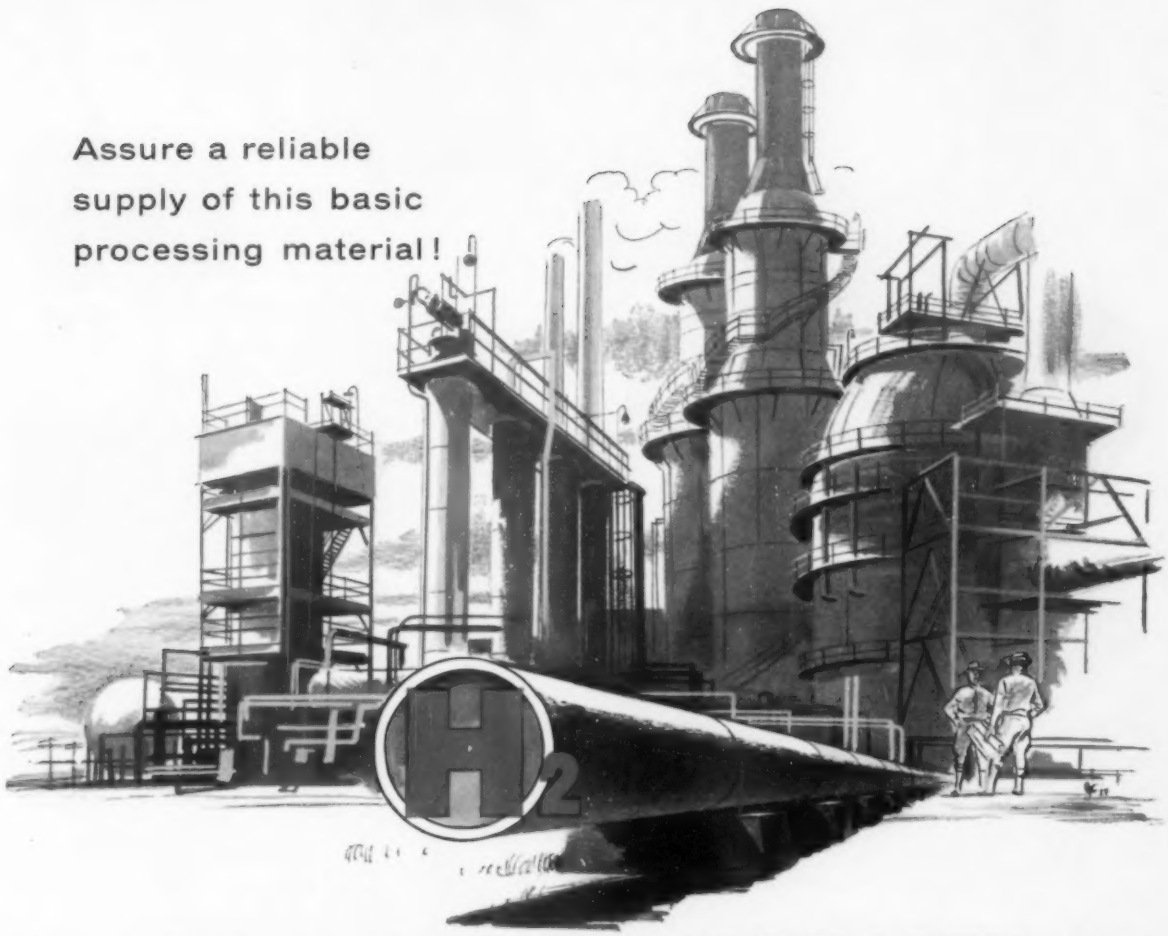
"While over the years this country can expect gradually to import more crude, it is only prudent in such troubled times to rely for imports mainly on our neighbors to the north and south, rather than to become heavily dependent on sources of crude halfway around the world."

Robert E. Wilson, chairman, Standard Oil Co. (Ind.), and Frank O. Prior, president, in an annual report statement.

Oil imports threaten coal

"We are fearful that when the emergency demand in Europe resulting from the Suez crisis is remedied the domestic coal industry will again be faced with competition from imported residual oil at cutthroat prices which will again result in the bread lines and relief rolls of the coal-producing areas.

"With the combination of low-cost production, Middle East oil and cheap foreign-flag tankers of terrific capacity, we must face realities and assume



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Most of the hydrogen plant capacity installed during the last ten years in the U.S.A. and Canada has been built by Girdler. So . . . to get top experience in hydrogen facilities . . . to assure utmost reliability of supply of this basic process material . . . call in Girdler when you start to plan.

There is a Girdler hydrogen plant for every need . . . any capacity . . . any hydrogen purity. Call or write for complete information.

The GIRDLER Company A DIVISION OF NATIONAL CYLINDER GAS COMPANY
LOUISVILLE 1, KENTUCKY

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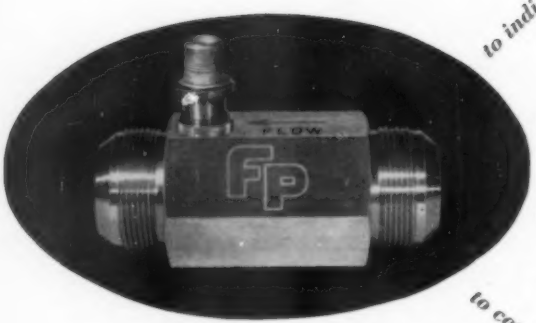
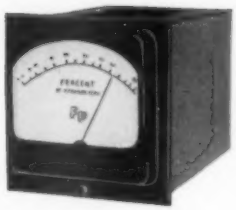
In Canada: Girdler Corporation of Canada, Ltd., Toronto, Ontario





PANEL FLOW RATE INDICATOR

to indicate flow

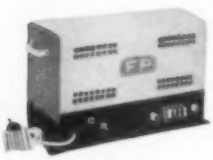
to indicate steady state flow condition

IN-LINE DIGITAL INDICATOR

to totalize flow for batch processes

DIGITAL TOTALIZER

to convert transient flow for analog output



FREQUENCY MULTIPLIER-CONVERTER

get flow information in any form you need it

. . . with F&P turbine meters and readout devices

Here's the ideal solution to flow metering problems characterized by high temperature, high pressure, high flow volume, or rapid flow transients. Fischer & Porter turbine meters are inherently among the most accurate flow measuring devices available today . . . providing measurements accurate to ½% of instantaneous rates.

The low inertia, axially balanced rotor of the F&P turbine meter gives optimum response to rapidly changing flow rates . . . providing positive information on changes as soon as they *begin*, not after they happen. A basic frequency output, directly proportional to flow, provides a common language easily fed to indicating, recording, or transmitting equipment. You can have digital or analog indication . . . oscilloscope recording . . . circular or strip chart recording . . . digital totalizing . . . transmission or any combination of these. Here are just a few of the Fischer & Porter output devices you can dovetail with one or more turbine meters:

PANEL FLOW RATE INDICATOR: Provides scale reading in desired flow units or in percentage of maximum flow. Includes amplifier which may be used to feed EPUT meters or integrators, and analog converter.

"IN-LINE" DIGITAL INDICATOR: Direct digital readout of flow information in desired gravimetric or volumetric units. Automatically selects turbine meter outputs by flow range.

DIGITAL TOTALIZER: Provides integrated flow information accurate to ½%.

FREQUENCY MULTIPLIER-CONVERTER: Extremely rapid response to transient flow signals. Sampling of eight points per cycle provides more information than conventional means.

For complete data on the F&P turbine meter and some of the systems it makes possible, write for catalog. Address request to Fischer & Porter Co., 3147 County Line Road, Hatboro, Penna.

FISCHER & PORTER CO.

Complete Process Instrumentation

that such a competitive threat will be leveled to the most highly concentrated petroleum consuming market in the world, namely, the United States. If such should happen there could only be one result and that will be to the detriment of the domestic coal industry, to say nothing of the domestic petroleum producing industry."

Daniel T. Buckley, National Coal Association, in a statement before a Senate subcommittee.

Wildcatter's incentive

"The simple truth is that there is no industrial path in the world strewn with as many economic skeletons as the trail of the oil wildcatter. And it is important to realize that he is responsible for the fact we have adequate supplies today because he discovered 75 per cent of the oil we have . . . We must keep alive the incentive for these pioneers.

"That incentive is lacking today. It has been erased by rising costs, inadequate prices, and the threat of continued year-to-year increases in imports of cheap foreign oil."

Walter S. Hallanan, president, Plymouth Oil Co. and The National Petroleum Council, in a statement before a House of Representatives committee studying petroleum supply.

Research fools pessimists

"Research and development within the petroleum industry have compensated for the fact that we are using up our old reservoirs and have enabled the industry to find new ones about as readily as in the past . . .

"Actually we have produced and sold many times over the past several decades the amount of oil which many persons said was all we had left."

E. Duer Reeves, executive vice president, Esso Research & Engineering Co., in a speech before German business leaders in Hamburg, Germany.

CALENDAR OF EVENTS

APRIL

8-10 American Society of Mechanical Engineers, spring meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala.

8-11 American Gas Association, distribution conference, Houston.

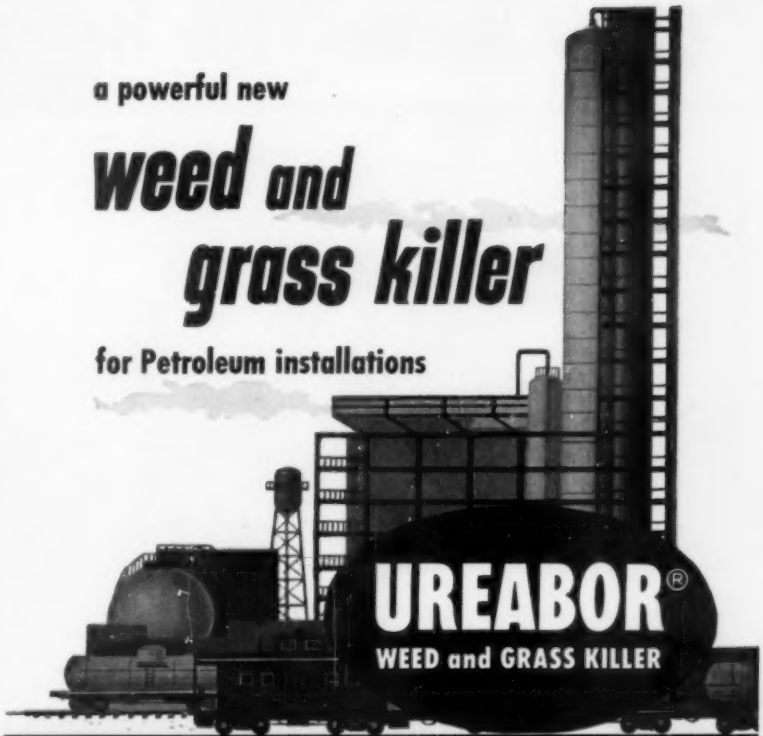
9 American Institute of Chemical Engineers, Philadelphia - Wilmington section, University of Pennsylvania, conference on catalysis in practice, University Museum, Philadelphia.

9-11 American Welding Society, fifth an-

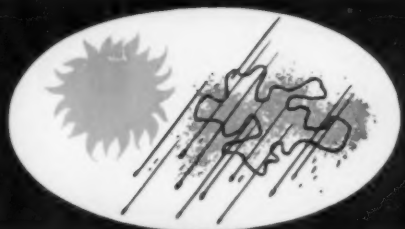
a powerful new

weed and grass killer

for Petroleum installations



you get full season's control from one application!



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A sturdy sling-strap unit made especially for fast, easy, accurate spreading of UREABOR at low rates. Holds enough UREABOR to treat 2500 sq. ft. at 1-pound rate. Simple action. Available at $10.75 delivered anywhere in the U.S.A.

UREABOR offers you release from your weed problems—with new ease and big economy. Never before, a weed killer like this! Apply it DRY—at thrifty, low rates. No mixing—no water hauling—just apply UREABOR direct from sack to weeds. Nothing could be simpler, or safer, to use anywhere. UREABOR is nonflammable, noncorrosive, nonpoisonous when used as directed . . . and effective!

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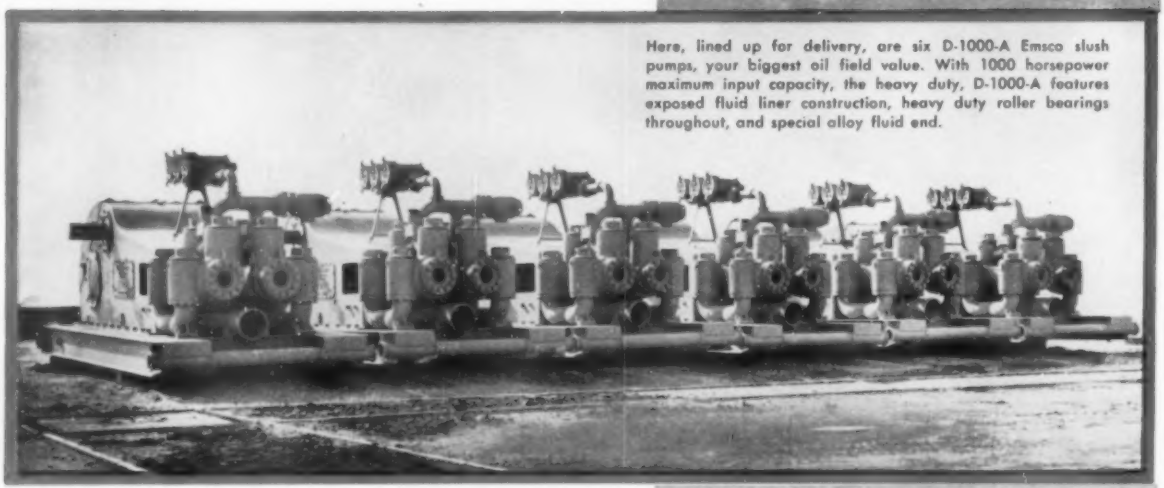
"6000 Horses" For Heavy-Duty Drilling



Here, lined up for delivery, are six D-1000-A Emsco slush pumps, your biggest oil field value. With 1000 horsepower maximum input capacity, the heavy duty, D-1000-A features exposed fluid liner construction, heavy duty roller bearings throughout, and special alloy fluid end.

EMSCO

REG U S PAT OFF

D-1000-A

Designed and built for extra heavy-duty performance, the D-1000-A slush pump provides the high fluid pressures and volumes you need for deep hole jet drilling. The low weight high performance feature of this pump is made possible by Emsco's fabriform construction. Like all Emsco slush pumps, the D-1000-A is dependable, economical, and easy to maintain. Let your Mid-Continent representative show you how this Emsco pump performs on the deepest holes.

MID-CONTINENT
Supply Company
MID-CONTINENT BLDG. FORT WORTH, TEXAS

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

nual welding show, Convention Hall, Philadelphia.

10-12 American Petroleum Institute, Mid-Continent district production division meeting, Mayo Hotel, Tulsa.

11 Illinois Oil and Gas Association, twelfth annual meeting, Mount Vernon, Ill.

11-12 West Texas Oil Lifting Short Course, Texas Technological College, Lubbock Tex.

11-13 Institute of Radio Engineers, ninth annual southwestern I.R.E. conference and electronics show, sponsored by Houston section, Shamrock Hilton Houston.

11-13 Institute of Radio Engineers, second national simulation conference, sponsored by Professional Group on Electronic Computers, Shamrock Hilton Hotel, Houston.

11-13 American Institute of Mining, Metallurgical, and Petroleum Engineers, Pacific Northwest Regional Conference, Portland, Ore.

16-18 Petroleum Industry Electrical Association annual meeting, Shamrock Hilton Hotel, Houston.

16-18 Petroleum Electric Suppliers Association, Shamrock Hilton Hotel, Houston.

16-18 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, Okla.

16-18 National Petroleum Association, fifty-fourth semiannual meeting, Cleveland.

17-18 Western Oil and Gas Association, annual Southern California safety conference, Pacific Coast club, Long Beach.

18-19 Texas Petroleum Research Committee and Permian Basin Section of American Institute of Mining, Metallurgical, and Petroleum Engineers, tenth annual oil-recovery conference, Midland, Tex.

22-25 Canadian Institute of Mining and Metallurgy, annual general meeting, Chateau Laurier, Ottawa.

24-26 Natural Gasoline Association of America, thirty-sixth annual convention, Rice Hotel, Houston.

24-26 American Petroleum Institute, Rocky Mountain district production division meeting, Gladstone, Townsend, and Henning Hotels, Casper, Wyo.

25-27 Appalachian Geological Society, Kentucky Geological Society, joint field conference, southeastern Kentucky.

25-27 American Association of Petroleum Landmen, third annual convention, Hilton Hotel, San Antonio, Tex.

27 American Institute of Chemical Engineers, Oklahoma state meeting, Bartlesville, Okla.

28-30 Independent Petroleum Association of America, midyear meeting, Buena Vista Hotel, Biloxi, Miss.

29-30 Automatic Control in the Petroleum and Chemical Industries, conference sponsored by the University of Oklahoma, extension study center, University of Oklahoma, Norman, Okla.

29-May 1 Southern Gas Association, annual convention, New Orleans.

MAY

1-3 American Petroleum Institute, Division of Production, eastern district meeting, William Penn Hotel, Pittsburgh.

6-8 American Petroleum Institute, annual pipeline conference, Cleveland Hotel, Cleveland.

6-8 American Geophysical Union, thirty-eighth annual meeting, National Academy of Sciences, Washington, D. C.

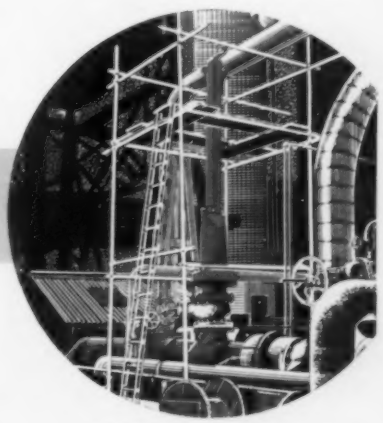
They're also

Big-Inch Tapping Operation

WmSON - HILLCO TAPPING MACHINES

FOR CUTTING BRANCH OPENINGS INTO HIGH PRESSURE OR HIGH TEMPERATURE PIPING Without Shutdown*

*All Machines tested to 2,175 p.s.i.



STOPPLE holding 400° F. steam

WmSON STOPPLE plugging machines

FOR MAKING REPAIRS AND ADDITIONS TO PIPING WHILE FLOW CONTINUES THROUGH TEMPORARY BY-PASS

MACHINES IN STOCK FOR:
PIPE SIZES 3" TO 36"
STEEL OR CAST IRON, CONTAINING:

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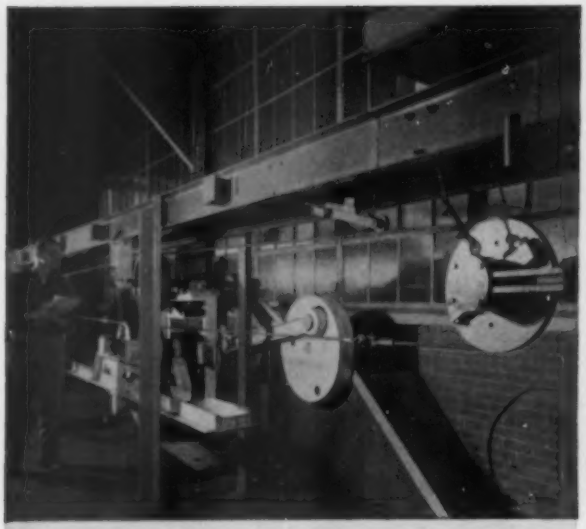
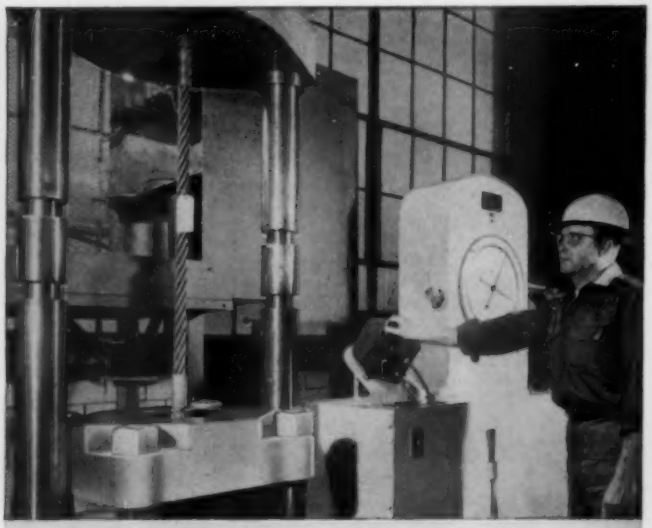
Why J&L wire rope service life



Fatigue machine. This 6 x 25 I.P.S. fiber core rope is being subjected to a continuous fatigue test to determine the number of reversed bends before breakage.



Cross-section tension test. This 1¼" 6 x 41 I.P.S.-RL fiber core rope was tested to 140,000 lbs. tensile load. Catalog requirement for same rope is only 123,000.

Vibration fatigue test subjects this boom pendant assembly to repeated shock loading. The 2,500 ft. lb. load provides action simulating actual field conditions.

Tension test of individual wires shows pounds of tensile load withstood before breaking. Every coil of wire used in J&L wire rope is thoroughly tested before acceptance.

salesmen can talk with confidence

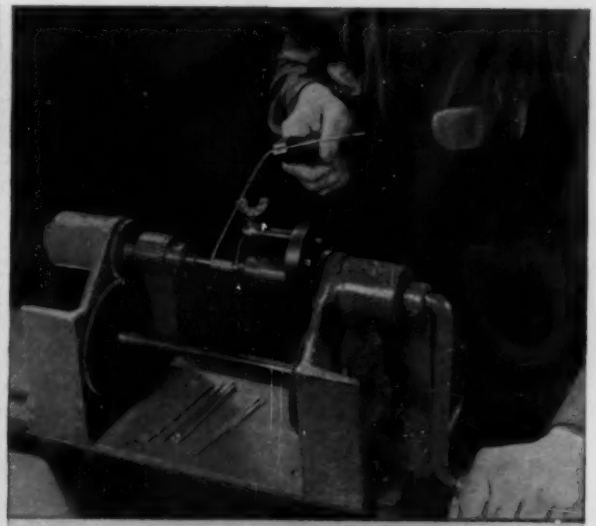
To users and buyers of wire rope, safety and long rope life are all-important considerations. When you specify J&L, you can be confident you are buying wire rope that will stand up to the job for which it is made.

Every strand of J&L wire, every finished wire rope, is subjected to exacting tests to determine maximum factors of strength, flexibility, abrasion and corrosion resistance. This quality control is a most important operation in the production of J&L wire rope. Shown here are some of the tests that enable your J&L wire rope salesman to talk about quality with confidence.

The next time you buy wire rope, call your nearby J&L representative, or write direct to the Jones & Laughlin Steel Corporation, Wire Rope Division, Muncy, Pennsylvania.

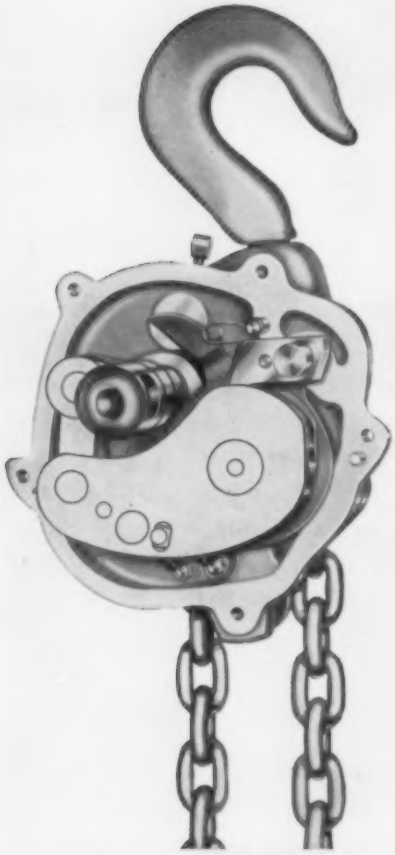
Jones & Laughlin
STEEL
. . . a great name in steel

Torsion machine tests ductility by twisting wire. This 8" length of .081 wire took 41 revolutions before snapping. Federal standards require only 26 revolutions.



Wrap test. Galvanized wire is wound eight times around a mandrel of its own diameter and then unwrapped, proving ductility of wire and the bond of the coating.

(Protective screens removed during photography.)



New Compound Levers

Make Coffing Super Powers the most efficient hoists in their class

Super Power hoists are designed around a new compound leverage principle. The levers, which replace the gears of conventional designs, enable workmen to raise loads with less handle pull than other hoists of the same capacities. Since use of the levers also reduces hoist size and weight, the workmen have 20% less weight to carry to the job.

Available in 1½ and 3 ton capacities in aluminum, and 1½ to 5 tons in malleable iron, Super Powers require little maintenance, since moving parts have sealed-in lubrication. Overload testing, "Safety Valve" handles, and constant load-locking ratchet and pawl assure safe operation. For complete details on these hoists, consult your favorite supply store or write to us for Bulletin L-3.

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Rachet Hoists, Electric Hoists, Load Binders, Spur Gear Hoists, Rachet Jacks, Screw Jacks, Hydraulic Jacks, Special Worm Gear Jacks

7	American Gas Association, committee on underground storage, operating section, Mark Hopkins Hotel, San Francisco.
8-10	Canadian Institute of Mining and Metallurgy, eighth annual convention, petroleum and natural-gas division, Macdonald Hotel, Edmonton.
8-10	American Gas Association, Pacific Coast Gas Association, gas supply, transmission, and storage conference, Mark Hopkins Hotel, San Francisco.
9	Panhandle Producers and Royalty Owners Association, annual meeting, Herring Hotel, Amarillo, Tex.
9-10	Fourth annual heat-transfer conference, Oklahoma A. & M. College, Student Union Building, Stillwater, Okla.
9-10	Symposium on use of surface active agents in water flooding, Pennsylvania State University, department of petroleum and natural gas, State College, Pa.
12-15	Liquefied Petroleum Gas Association, annual meeting, Conrad Hilton Hotel, Chicago.
13-15	Industrial Waste Conference, sponsored by Purdue University, Purdue Memorial Union Building, Lafayette, Ind.
13-16	American Petroleum Institute, division of refining, midyear meeting, Sheraton Hotel, Philadelphia.
14-16	Industrial Nuclear Technology Conference, sponsored by Armour Research Foundation of Illinois Institute of Technology and Nucleonics Magazine, Museum of Science and Industry, Chicago.
16-17	American Right of Way Association, third annual national seminar, Conrad Hilton Hotel, Chicago.
16-17	American Petroleum Institute, division of production, Pacific Coast district meeting, Hotel Biltmore, Los Angeles.
16-18	Geological Society of America, southeastern section, annual meeting, Morgantown, W. Va.
19-22	Texas Independent Producers and Royalty Owners Association, Galvez and Buccaneer Hotel, Galveston, Tex.
20-22	American Petroleum Institute, division of transportation, central committee on transportation by water and tanker corrosion symposium, San Francisco.
20-22	American Gas Association, chemical, engineering, and manufactured gas production conference, Balmoral Hotel, Bal Harbour, Fla.
20-23	American Society of Mechanical Engineers, twenty-ninth annual conference and exhibit of the oil and gas power division, Kentucky Hotel, Louisville, Ky.
21-23	Pennsylvania Gas Association, annual meeting, Pocono Manor Inn, Pocono Manor, Pa.
23-24	Kentucky Oil and Gas Association, annual membership meeting, Hotel Phoenix, Lexington, Ky.
23-24	American Institute of Mining, Metallurgical, and Petroleum Engineers, third annual joint meeting, Rocky Mountain petroleum sections, Northern Hotel, Billings, Mont.
23-24	Western Petroleum Refiners Association, southwest regional technical-industrial relations meeting, Hotel Paso del Norte, El Paso, Tex.
27-29	Rocky Mountain Oil and Gas Association, twelfth annual convention, Denver.
29-31	Annual short course in gas technology, Texas College of Arts and Industries, Kingsville, Tex.

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Meet this Magcobar Man, the barite plant worker who helps process millions of tons of Magcobar every year

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Complete
DRILLING MUD SERVICE

That's almost certain to be the plight of companies who don't plan for their tank car requirements in the decade ahead. It's no secret that available general-purpose tank cars are going to be limited. With normal obsolescence of today's facilities, the continuing steel shortage, and with forecasts pointing to a more than 50% expansion in our economy, *liquid product shipments may be difficult . . . may miss tomorrow's sales opportunities.*

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the OIL AND GAS JOURNAL

TULSA, OKLAHOMA

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JOURNALLY SPEAKING . . .

So Little Time

ONCE in a while an otherwise-rational person will say "The Journal's a good magazine, but I just don't have time to read."

This makes us all feel very sad, after all the work we do to pack the Big Yellow Book every week with the choicest of reading matter which we are sure is of transcendent importance to just anybody in the oil business.

Apparently other publishers have heard the same complaint. For in another magazine we found a list of 10 helpful hints for getting more reading done. Since these are all such eminently practical suggestions, we swiped the list — with slight adaptations for Journal readers, or rather for Journal nonreaders.

1. Talk less. (One guy spent an hour and a half telling us why he didn't have time to read.)

2. Turn off the TV. (Leave the juvenile programs to the kids. Get your relaxation by improving your mind with our favorite oil publication.)

3. Carry the Journal with you always. (Any tailor can enlarge your hip pocket so it will slip in nicely. Then you can whip it out and read on plane, train, or bus; while waiting for an elevator or standing in the cafeteria line.)

4. Put the Journal under your pillow at night; if you can't sleep, read. (This we like. It's such an affectionate sentiment. But if it makes the pillow too lumpy, throw it out and sleep.)

5. Wake up 15 minutes earlier every morning and read. (That's the way it was in the list. It would take us that extra 15 minutes to get our eyes open enough to read.)

6. Keep the Journal handy to pick up at odd moments. (Odd moments like when your wife is telling you what needs to be done around the house, or when cut off in a long-distance call.)

7. Read it while waiting for appointments with unpunctual people. (Or during a boring staff meeting.)

8. Take it to the dentist's office. (Why read his old magazines when you can supply your own? Besides, reading about the oil industry's troubles will take your mind off yours.)

9. Keep a copy in your car. (You can read several issues while held up at red lights, or when your wife says she will be in the store only a minute.)

10. Remember that a book in the hand is worth two in the bookcase. (If you get the habit of walking around with a Journal in your hand all the time you will acquire the reputation of being a very studious person. And if you carry several copies, the boss may break down and buy you a bookcase.)

Well, there's the list. Even if you don't follow all 10 rules literally, we hope you get the idea you can find more time to read the Journal if you really try.

And to make it still easier for time-harried readers, we've done something which should be a big help to everybody but particularly to those who do most of their reading under the conditions described in Rules 6, 7, and 9.

For the past couple of issues, now, we've been stapling just inside the front cover a four-page "Journal News Letter." If you don't have time to read anything else in the Big Yellow Book, you certainly can work this in. It's even worth getting up 15 minutes earlier in the morning to read—but 10 minutes will do it.

This news letter is a condensation of all the best in the Journal—which positively makes it the *creme de la creme*. Skimming it will give you the highspots of the week's oil doings all over the world. It will also tell you where to find the details of just what you want to read in that issue—thus saving you so much time that you can ignore Rule 2.

Furthermore and to boot, we often slip in little gems of gossip, rumor, forecast, speculation, and opinion, plus some last-minute news flashes that don't appear in the body of the book.

It's absolutely the hottest four pages of reading matter in the whole oil and gas industry, and you'll want to read it whether you have time or not. We'll even promise that if you become a regular reader of it you won't have to follow the other 10 rules.

—Henry D. Ralph.

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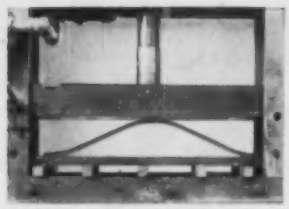
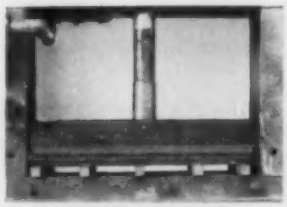
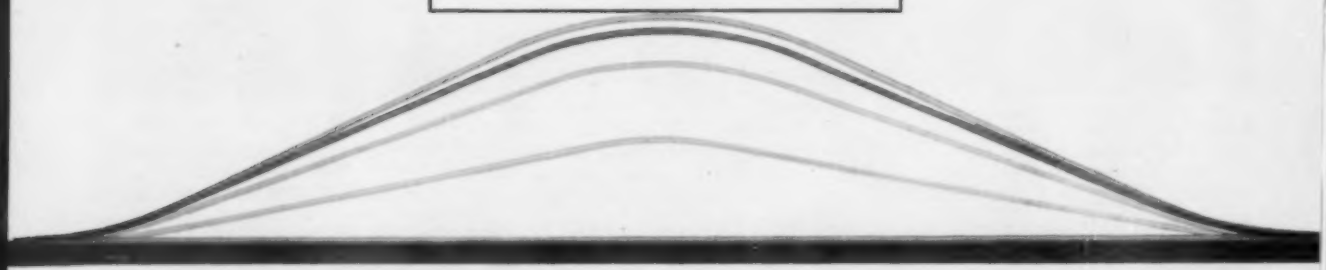


Spring in position in hydraulic press for flattening test.



The tightest hole could not flatten any spring more than this.

The specified bowed height (reach) must be present after the slight permanent set.



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CASING CENTRALIZERS

Peace and spring can mean double trouble

SIGNS of peace in the Middle East and signs of spring at home are wonderful and welcome, but the fact that they are both bursting out all over at the same time brings a train of special problems to the domestic oil industry.

The first convoys have moved through the Suez Canal. The first tanker has loaded from the Iraq pipeline. Middle East oil will shortly be flowing westward in increasing volume.

Europe has passed its oil crisis. Its heating season is nearly over and its storage tanks are nearly full. Its interest in buying U. S. oil is flagging, and will fade with each sunny day and each tanker journey through the Mediterranean.

ON TOP OF THIS, the industry is entering its annual spring doldrums. The next couple of months are the low point of the year in consumption of petroleum products. The spring quarter traditionally brings troubles of excess supplies.

Every year after a winter of high crude production and high refinery runs, the industry has trouble adjusting to the reduced demand. This year it has double trouble. The job of supplying Europe with some half-million barrels per day has built up an extraordinary momentum in the industry, and this momentum will be hard to slow down.

Texas took a wise step when it slashed its April allowables. Other states are moving in the same direction. It remains to be seen whether this will be enough. If not, producers should be reconciled to a further curtailment by the fact that they got a price increase in January. And they should remember that this increase was caused by the law of supply and demand and that this law can work both ways.

THE ONE BRIGHT SPOT in the picture is crude stocks. They are down to minimum working levels, and could stand a little expansion. But unless the situation is watched closely they could rise fast and soon be back up to their former oppressively high levels.

Products stocks are all high, and gasoline inventories are really excessive. The recent modest decline in refinery runs will continue for 2 or 3 weeks and then undoubtedly will begin to move up briskly. If this prevents reduction in gasoline stocks there will be trouble for the whole industry, including producers.

Refiners seem prone to run all the crude they can get, regardless of the current need for gasoline. So the only practical way to keep the industry in balance is to prevent crude supplies from being excessive.

Producers and state commissions should watch the over-all industry trends—including particularly the import prospects—more closely than ever this spring lest they throw away their present advantageous position.

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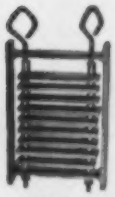

Do you know that Inco sets up a test rack containing a large selection of alloys in critical hot spots in many types of operations: — one rack or more . . . whatever it takes to find out which alloy stands up best under a host of varying high temperature conditions.

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ELTON HYDER, JR., left, led off for Texas independents. His charge: Big pipelines deny service to producers, yet step up own imports.

DAN MOODY, right, former Texas governor, spoke for the pipelines. He won recess to study various charges, prepare for his turn as . . .

Texas Pipelines, Producers Square Off

AUSTIN.—The battle is on in Austin between independent producers and major pipelines in Texas.

The independents paraded before the Texas Railroad Commission for 2½ days last week in an effort to back up their charges that common-carrier lines are throttling inland Texas production in order to fill a growing domestic demand with imports.

The hearing was recessed April 3 when the producers closed their testimony. The recess was ordered to give the pipelines and the commission time to study the evidence. The hearing will reconvene at 2 p.m. May 13.

The producers allege the lines are being operated illegally as private carriers since they refuse to connect new production, to extend gathering lines, and to expand trunk lines.

The producers witnesses are members of the Texas Independent Producers and Royalty Owners Association, the West Central Texas Oil and Gas Association, the North Texas Oil and Gas Association, the East Texas Oil Association, and the Panhandle Producers and Royalty Owners Association.

Elton Hyder, Jr., Fort Worth attorney for the associations, opened the attack for the independents with a general statement outlining the alleged abuses and remedial action needed.

He was challenged immediately by Dan Moody, former governor of Texas and attorney for Shell Pipe Line Corp. Moody, apparently acting as spokesman for the pipelines, urged the commission to recess the hearing until such time as the independents made "specific charges on specific cases." No pipeline company, he said, can be adequately prepared to defend itself against such general charges. His motion was overruled by Commission Chairman Olin Culberson.

Trucking growing . . . In his statement, Hyder pointed out that there are more than 8,000 wells without pipeline connections in Texas now.

This situation, he said, has arisen only since imports started invading the United States in large volume.

In 1938, he said, one of the commissioners told the Congress that every oil well in the state (87,000 wells), except for a few isolated new wildcats, were connected to pipelines and each was running its allowable each day.

Pipelines then he said were willing to connect all wells, and some were bound to be uneconomic. In 1936 per well production was 18.5 bbl. daily, while in 1956 it was 17.9 bbl. daily.

Texas, Hyder said, had .185 mile of gathering lines per well and 6.95 bbl. of trunk-line space to each bar-

R. S. ANDERSON
. . . $200,000 for trucking fees

rel of production in 1936. In 1955, the state had only .164 mile of gathering lines per well and 6.66 bbl. of trunk line to each barrel of production.

"Between 1936 and 1955, we find that production increased 257 per cent, the number of producing wells 233 per cent, and reserves 233 per cent. Yet our gathering lines increased only 206 per cent and their capacity only 211 per cent.

"The result: We find that the amount of oil trucked to market since 1948 alone has increased 637 per cent."

In 1956 in new fields with no connections, Hyder said, the average well made 20 bbl. daily. Last year there were 6,066 unconnected wells in the state in fields where other wells were connected. The remainder were in pools not served by pipelines.

Buyer violation charged . . . Hyder charged that common purchasers are violating the state's common-purchaser act by buying one producer's oil at the buyer's expense but requiring others to pay part or all the gathering charge. This, he said, is selective buying and should be prohibited.

The commission, the independents urged, should either:

. . . Order common-carrier lines to connect immediately all unconnected wells in that state and make the needed expansions of trunk and gathering systems to do this.

. . . Or order common purchasers to pay trucking tariffs the same as they pay pipeline gathering tariffs until all wells are connected.

The commission, it says, has the power to do either or both under present laws.

How about economics? . . . Producers expect pipelines to base much of their defense on the premise that the lines can't be ordered to connect wells or expand systems when such would involve financial loss.

Anticipating this, Hyder quoted a statute giving the commission the power to order expansion or extension of pipelines. It could do this if it found following hearing that the expansion was "reasonable, in the public interest, and not so costly as to impair the ability of the common carrier to perform its duty to the public."

This does not mean, Hyder said, that the carrier must make a profit on every well it connects. It means merely that the carrier is entitled to a fair return on its investment from its total operation.

Hyder said Texas laws guarantee fair returns to common carriers. If, by connecting all wells in its area, a carrier finds that it is not making a fair return, it need only file a petition with the commission for a tariff increase.

He charged further that the carriers are making far more than fair rate of return on their investments.

The crux of the matter . . . Hyder said the 10 trunk lines starting in or running through the West, West Central, and North Texas districts are owned by "Gulf, Shell, Indiana Standard, Texaco, Phillips, Humble (Standard Oil Co. of New Jersey), Magnolia (Socony-Mobil), Atlantic, and Sun."

All of these "are common purchasers of crude in Texas as defined by statute. They are likewise all heavy importers of crude."

Seven of these nine firms, Hyder said, rank when affiliation is considered among the 12 largest importers of oil in the U. S.

"We ask, if your main objective is bringing your own foreign crude in increasing amounts each year to the American seaboard, are you, or can you be, realistically interested in increasing your facilities to bring the oil belonging to or purchased in part from others in West Texas to that American seaboard?"

We Still Have a Few

If you intended to get extra copies of "Oil Hits Back" and didn't, you still have an opportunity.

Until the supply is exhausted—and it nearly is—you can get extra copies of this 16-page defense of the oil industry by contacting:

Reader Service Department
The Oil and Gas Journal
Box 1260, Tulsa

GEORGE MITCHELL
. . . Development in Wise hurting

"We suggest that that is the very heart of this situation."

Cases documented . . . Hyder called producers throughout April 1 and 2 to give sworn testimony on their wells without connections and their efforts to get connections.

George Mitchell, of Christie, Mitchell & Mitchell, Houston, testified that his firm has 75 wells without connections in Coffin, Alvord, and Miles-Jackson fields in Wise County.

Mitchell said the company made its first effort to get a pipeline outlet early in 1955 and has been contacting the lines steadily since with no results. The oil is trucked to The Texas Co. and sold on a trade-out to Cities Service Oil Co. Trucking charge is 12½ to 15 cents a barrel, Mitchell said.

The three fields have a total of 124 unconnected wells with production of about 129,000 bbl. monthly. Mitchell said proved reserves are about 29,500,000 bbl. Producers have produced and sold about 2,000,000 bbl. so far.

Mitchell said his company's losses due to trucking run from $15,000 to $20,000 a month.

He said the operators had approached Cities Service, Indiana Oil Purchasing, Sinclair, Magnolia, Continental, and Texaco to take the oil. Texas Pipe Line, Magnolia Pipe Line, and Sinclair Pipe Line have crude lines running within 10 miles of the fields, Mitchell said.

Varel without market . . . E. L. Wilson, Dallas operator, told the commission 96 unconnected wells in Varel field in Howard County were cut off from a market altogether as of April 1.

Wilson spoke for himself; Dan Varel, of Dallas; Roark & Hooker of Abilene, Tex.; and A. G. Hill, Dallas.

Combined, he said, these operators own 65 of the wells in the field.

Wilson said the field was discovered in February 1955. It was able to market by truck to Midland (with Gulf the buyer) only 50 to 60 per cent of its allowable until the past 60 days.

Through February and March, he said, Atlantic Refining (Gulf stopped its purchases) took the entire 2,500-bbl.-daily field allowable at Midland due to a Suez-inspired oil shortage. Atlantic, he said, declined to take any more Varel crude after March 31. And the field now is without a market.

Varel field reserves, Wilson said, are about 5,000,000 bbl. primary and "at least that much more in secondary oil."

The operators have had to pay 28 cents a barrel trucking charge on what oil they could sell. This has mounted to a trucking outgo so far of almost a quarter of a million dollars since 1955, Wilson said.

The operators have been trying for a connection since the discovery. Shell, Magnolia, Basin Pipe Line, and Mesa Pipe Line have large trunk lines from 1.2 to 9 miles from the field. Wilson said the operators had tried for connection several times from all of these and from Cosden Petroleum Corp. whose Big Spring refinery is 9 miles from the field.

Other producers told similar stories, some detailing situations wherein some wells in a field had connections while others did not.

What's to come . . . Few are eager to predict what action, if any, the commission may take as a result of the hearing.

It is generally expected that the fracas will drag out for some time.

There are signs that the pipelines, as their main defense, will argue that the producers want to sell oil not just move it. They will point out that a common-carrier moves oil for anyone but does not buy it.

One pipeline representative likens the common-carrier line to a railroad—pointing out that anyone can ship on the road but that the railroad doesn't buy the freight. Producers, he said, are the same as asking "the railroad to buy their freight."

Some observers feel that little will come from the hearing.

Others think that the commission may order connection of unconnected wells in fields where other wells have pipeline outlet. A few think the producers stand a good chance of getting all wells in Texas connected and of forcing expansion of the lines from inland areas to market.

Nearly all agree that it will be some time before the issue is decided.

watching WASHINGTON

. . . with Bertram F. Linz

Douglas on depletion . . .

HOW about a sliding scale of depletion for oil and gas?

Sen. Paul H. Douglas of Illinois thinks it would be fine. He thinks the little operator with an income of less than $1 million a year should get the present 27½ per cent. If the operator's income is over $1 million, but less than $5 million he should get 21 per cent. But the big operator and corporations would be limited to 15 per cent.

The idea brought no applause from senators from the oil states. "Oilman Rich" can still have his million a year and depletion, Sen. Russell B. Long of Louisiana, jeered. But "Grandma Jones," with $200 worth of stock in an oil company, is to lose a big chunk of her meager income.

If the aim is to get more money from companies operating abroad, it isn't going to succeed, Long assured Douglas. Foreign nations "adjust" their taxes to U. S. scales, he explained. If the U. S. depletion allowance is cut, the foreign countries will follow suit. Since taxes paid abroad are credited against the U. S. income tax, the result would be higher tax payments abroad. But the U. S. Treasury wouldn't get any more revenue.

The issue isn't going to die immediately, however. Sen. John A. Carroll of Colorado is pressing for a study of depletion allowed on oil produced abroad. Carroll already has written a bill to bar this depletion, but has not yet introduced it.

I.A.M. looks at automation . . .

LABOR'S drive for a 30-hour week with 40-hour pay is getting under way.

Automation and atomic energy will make the shorter week a must within the next few years if all of the 80,000,000 workers expected by 1965 are to have jobs, labor leaders say.

There will be no immediate demand for a 30-hour week. The effort will be directed toward a gradual reduction of hours. But the nation must realize it will face an industrial and economic crisis beating anything we ever saw unless this is done, unionists warn.

The frst move to get the drive under way was taken by the million-member International Association of Machinists.

The I.A.M. has asked all its locals to study and report on local conditions.

Faith in "good faith" . . .

THE Justice Department is against any tampering with the Supreme Court's "good faith" ruling in the Standard Oil Co. (Ind.) case.

The right of a seller to meet isolated instances of competition without lowering his prices to all customers is an "essential qualification" of any antiprice discrimination law, according to Asst. Atty. Gen. Victor Hansen.

The department is opposed to the Kefauver bill to further restrict the good-faith defense. Hansen warned Kefauver's judiciary subcommittee that it would bring the Robinson-Patman Act into conflict with the Sherman antitrust act.

Most of the witnesses before the Kefauver group have opposed the bill. This month they are expected to give their views to the House judiciary committee in hearings on a similar bill by Rep. Wright Patman of Texas.

The Patman bill passed the House last year by a 393-3 vote. The question now is whether the much stronger objections voiced in the hearings this year will have any great influence. Both Patman and Kefauver are firmly committed to the bill. And the measure is something of a "must" in the House, where Democratic leaders support it.

Before the storm which toppled it, "Mr. Gus" stands with an 8° list.

Disaster Strikes Fabulous "Mr. Gus"

CORPUS CHRISTI.—The illustrious "Mr. Gus," one of the biggest and most expensive offshore drilling platforms ever built, capsized in 40-ft. waters of the Gulf of Mexico last week.

The $3,500,000 mobile unit foundered at 6:30 a. m. Wednesday after listing at a perilous angle for more than 2 days.

Designed to withstand hurricane winds of 125 miles an hour, the mighty structure was toppled by gusts estimated at only 40 to 45 miles per hour. It splashed into the sea as a storm along the South Texas coast hammered against it with 15 to 18 ft. waves.

The crew abandoned the ill-fated vessel late Sunday shortly after the gulf floor gave way under one side of it. There were no injuries reported.

Immediately after the accident, C. G. Glasscock Drilling Co., owners of the unit, started making plans to salvage it. Most offshore experts agreed that the unit can be salvaged, but cost of the job may be prohibitive.

"Mr. Gus" started wobbling when its lower hull was being raised. It had just finished drilling a 14,042-ft. dry hole for Sun Oil Co. in State Block 974 about 4 miles off Padre Island 30 miles south of Corpus Christi. The unit was being raised to a floating position to be towed to its next drilling location.

As the submerged hull started up, weight of the unit shifted to the eight columns. The piles on one side plunged deeper into the gulf, tilting the entire platform at an angle of about 8° (see photo).

A huge derrick barge, one of the most powerful operating on the gulf, was immediately summoned for help.

The construction vessel, owned by J. Ray McDermott & Co., Inc., was helping erect a platform on a Gulf Oil Corp. lease, about 25 miles to the northeast. Its towering crane, together with auxiliary equipment, has an 800-ton capacity.

Once the derrick barge was tied to the foundering platform, "Mr. Gus" appeared ready to win another of its many fights against the sea. Reports from the rig Tuesday afternoon indicated it was not in grave danger.

But the tricky old gulf lashed back with sudden fury. A storm sneaked in on the crippled vessel Tuesday night. Lines strained against the pounding of waves and shifting winds. The listing vessel, its long legs still planted deep in the mud of the gulf bottom, leaned heavily seaward as the long night wore on.

Suddenly, about daybreak, the anchor line on the derrick barge snapped. The drilling derrick, towering the height of a 20-story building above the turbulent gulf waters, plummeted into the sea.

The eight steel piles, each 4 ft. in diameter and more than 200 ft. in length, heaved a mighty groan as they surrendered to nature's fury. Salt water gushed in through the 5-ft. access tubes connecting the upper deck with pumps and other equipment in the lower hull.

The mighty "Mr. Gus" was reduced to tons of twisted steel and rubble. It had been built to resist any storm that might be expected to hit it for 25 years. But its career was ended—at least temporarily—less than 2½ years after its commissioning.

Barge threatened . . . Early reports reaching shore indicated "Mr. Gus" almost took the McDermott barge with it.

But later reports said the vessel, though damaged, was on its way back to port. Holes reportedly were torn in its hull when "Mr. Gus" fell.

Both vessels were insured heavily against various types of accidents, the amount of coverage was not disclosed. A part of the insurance on "Mr. Gus" was carried by Lloyds of London.

J. C. Storm, Glasscock vice president, said the platform might have been easily saved if the storm had not arisen so soon. Ironically, the wind subsided soon after the vessel collapsed.

Wednesday afternoon, small waves stirred up by a mild west breeze lapped gently at the remains of "Mr. Gus" which were visible above water.

After the vessel had settled into the mud there was only about 25 per cent of it protruding from the water.

Turbulent history . . . The capsized drilling platform has had a generous share of hardships during its brief but violent career.

Commissioned in November 1954, the unit didn't start drilling until 5 months later. It broke a leg while setting up on its first location.

After being towed back to port and repaired, the vessel tore loose in a storm while being towed to location a second time. The crew was rescued, leaving the platform to float 10 miles seaward.

Early in its career, the vessel was taken back to the yard for extensive overhauling. It was built as two platforms joined by a catwalk, but the catwalk later was discarded and the two decks were joined.

Having got its feet wet several times, "Mr. Gus" again was towed back to port. This time, after proving itself in operation, the unit had extensions put on its massive legs, then it was ready for deeper water.

In one of the freak accidents which plagued it, an oil-field service man was killed while being transferred between a crew boat and the platform 40 ft. above water. Talk of a "jinx" was revived when three persons were killed in a helicopter crash while returning from the vessel.

Hard-luck pioneer . . . Nature below the surface of the earth had been little more cooperative with "Mr. Gus" than had the air and sea above.

The giant drilling platform had a dry-hole record to rival that of any unit in the gulf. Since starting to work in April 1955 "Mr. Gus" established production in only three wells. Most of its wells, though, were in the Texas tidelands, where oil is much harder to find than it is off Louisiana's coast.

(Reports varied as to whether the vessel had just finished its thirteenth well or was preparing to start its thirteenth when it capsized.)

"Mr. Gus" was a pioneer in offshore drilling; like most pioneers, it thrived on obstacles.

As the first mobile platform designed to drill in 100 ft. of water, the mammoth unit already had made believers out of many skeptics.

In its prime, "Mr. Gus" was a smooth operating hunk of seagoing machinery. The giant platform could set itself down on location and start drilling within hours. Its sprawling deck, some 220 ft. long and 60 ft. wide, had proved stable in winds up to 94 miles an hour.

One of the unit's greatest triumphs was drilling more than 60 miles from shore, farther seaward than any other well ever attempted before or since. Through no fault of the drilling unit, this test became famous for being one of the most expensive dry holes ever drilled.

Higher rates? . . . The misfortune of "Mr. Gus" sent a cold shiver down the spines of offshore operators throughout the gulf area.

Unlike the Glasscock firm, which still has one offshore rig and eight inland barges in operation, some seagoing companies could be wiped out by such a disaster.

The fate of "Mr. Gus" undoubtedly will have its effect on other offshore operators—both producers and drilling contractors.

Insurance rates likely will go up, followed by drilling rates. Increased costs, regardless of their origin, will make the tidelands look less and less appealing. Most offshore operators already have decided that cutting costs is the best way—perhaps the only way—to win in the tidelands.

"Mr. Gus" was designed to help them cut costs. To some extent it succeeded, for it popularized the mobile platform.

Glasscock soon will be back in the offshore gamble with another ante. But this ante, instead of being $3,500,000, will be $6,500,000.

The company's "Mr. Gus II" will be commissioned soon at the Bethlehem shipyard in Beaumont, where the earlier unit was built. The ceremony has been set tentatively for May 31.

The No. 2, built along the same lines as the older vessel, will be much bigger. It is designed to work in water deeper than any yet tested. Perhaps it will have a better chance to succeed because of the experience gained through "Mr. Gus."

Kermac Barge Listing

MORGAN CITY, La.—A drilling barge was in trouble off the coast of Louisiana last week.

Kerr-McGee Oil Industries, Inc., reported its Rig 40 was listing about 18° in shallow water but appeared in no great danger of toppling. The barge, built about 9 years ago, was the first submersible type unit ever used in the gulf. It is believed to have drilled more offshore wells than any other rig.

A storm hit after damaged pontoons had been removed for repairs. The unit was moved a short distance from the location in Block 31, Ship Shoal area, leaving about 2,000 ft. of open hole in an unfinished well which had been drilled to 12,696 ft. Location is in about 18 ft. of water 9 miles from shore.

A derrick barge was sent to stabilize the barge to permit repairs.

Billions Ride on Turn of Court Case

● Two big questions lie concealed behind opening arguments in famous Louisiana boundary dispute with Government. Supreme Court will decide one: Does state control 3 miles or 3 leagues from coast? Still unanswered: Where does coast begin?

Joe Reilly
Gulf Coast District Editor

THE U. S. Supreme Court this week will hear arguments in the celebrated dispute between the United States and Louisiana over conflicting claims to oil-rich lands underlying the Gulf of Mexico.

Billions of dollars will rest on the decision. Moneywise, the case is one of the most important ever heard by the Supreme Court. Royalties and rentals from the rich tidelands would bulge the coffers of the winning party for years to come.

The famous "nine old men," revitalized by recent transfusions of younger blood, will be asked to hand down a ruling which might easily sway future concepts of national and international law.

Much more than money or property is involved in the case. It embraces one of the hottest political issues of our day—state's rights. And it may set a precedent for future claims under international waters.

The oil industry itself is little concerned with the legal precedents involved. It makes little difference to oil men whether their royalty and lease payments on a certain tract go to the federal or the state government. The industry is willing to work under either landlord, but it's tired of paying double homage for a single lease.

Nevertheless, the harried offshore operator has a big stake in the so-called tidelands case. A ruling would do more than determine who his landlord will be. Also hinging on the case are these vital questions:

... **Can the offshore** oil operator conduct his affairs on a businesslike basis, with confidence that the landlord will live up to his contract?

... **Or will he face** continued political bickering which already has cost him millions of dollars?

Another offshore shutdown such as the one imposed by the Supreme Court last year would have far-reaching effects. It would hurt the nation's economy as well as the oil industry itself.

The offshore area is frequently referred to as this country's last great oil frontier. Because of its promise it commands a big share of drilling and exploration budgets. If oil companies can't operate there without undue restrictions, they will pour more and more money into foreign fields.

What's Involved

The case now before the Supreme Court covers only one phase of the offshore entanglement.

As plaintiff, the U. S. is trying to establish its claim to submerged lands and minerals under the Gulf of Mexico lying more than 3 miles seaward from the Louisiana "coast." But it is not asking the court to define the coast line.

If the court rules only on this 3-mile question, it would reduce the width of the disputed belt by about 7½ miles, no matter which way it rules.

For example, if it rules in favor of the U. S., the federal Government would gain undisputed title to the 7½-mile strip on the outer edge of the present disputed zone.

If it rules for the state, Louisiana would gain undisputed title 10½ miles seaward from its present shore line. Since ownership out to the 3-mile limit is not disputed, such a decision would lop a 7½-mile strip off the inner edge of the present disputed zone.

The coast line problem . . . Louisiana claims a belt extending 3 leagues (about 10½ miles) from a state-defined "coast line."

This line, in some sectors, is about 25 miles from dry land. Therefore, the disputed zone still would be nearly 30 miles wide in places.

Louisiana has injected into the case the problem of defining the actual coast line. If the court chooses, then, it may settle both phases of the dispute in one ruling. Actual drawing of the coast line could await further decrees based on ground rules laid down in this case.

However, there is no hint how broad the court's ruling will be or how soon it will be handed down.

The U. S. went to court in the present case December 19, 1955. On June 11, 1956, nearly 6 months later, the court issued an order barring further leasing or drilling of new wells in the disputed zone. This order remained in effect until the disputing agencies worked out a compromise 4 months later. The truce permits new drilling in the area.

This apparent reluctance on the part of the court has led to speculation that the issue eventually may be settled by political, rather than judicial, means. In fact, in one argument, Louisiana has maintained this is a political question and should not be settled by the court. A compromise might be passed by Congress and the Louisiana Legislature to settle the dispute.

The tidelands debate has been in and out of court many times in recent years. Some of the questions involved in the current case date back to earlier law suits involving California and Texas. Others go clear back to the Louisiana Purchase and beyond, to the days of Spanish rule.

Here, minus some of the legal cobwebs, are basic arguments involved in the current case:

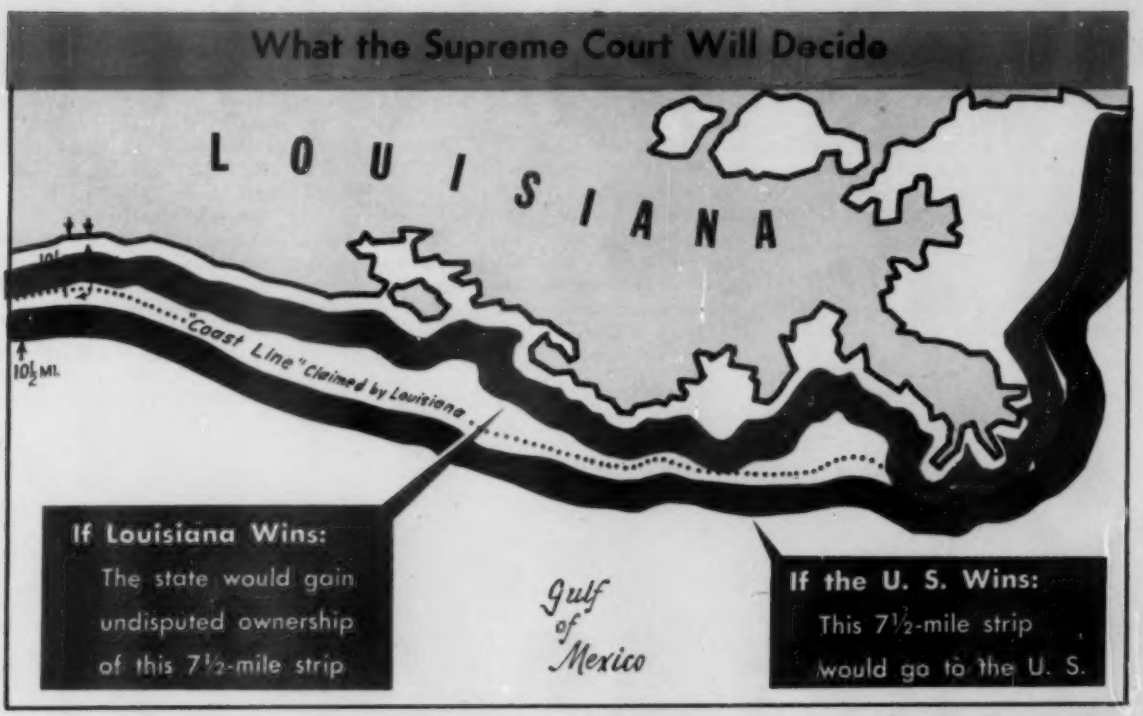
Basis of U. S. Case

The question of ownership of the U. S. tidelands caused little stir until the late 1930's. It arose when oil prospects in the Gulf of Mexico and off the coast of California became apparent.

On September 28, 1945, President Harry Truman issued a precedent-setting proclamation. He declared that the U. S. Government considered the Continental Shelf adjoining the states "subject to its jurisdiction and control." He added that "the Continental Shelf may be regarded as an extension of the land-mass of the coastal nation and thus naturally appurtenant to it."

This proclamation, according to some attorneys, introduced a new legal concept. It established a claim to jurisdiction, but it did not proclaim outright ownership of the submerged lands.

Two years later the Supreme Court furthered this concept. It declared the now-famous "paramount rights" doctrine. This principle was applied in


What the Supreme Court Will Decide
LOUISIANA
"Coast Line" Claimed by Louisiana
10½ MI.
If Louisiana Wins:
The state would gain undisputed ownership of this 7½-mile strip
Gulf of Mexico
If the U. S. Wins:
This 7½-mile strip would go to the U. S.

cases involving the tidelands off California, Texas, and Louisiana. It gave the U. S. jurisdiction over the Continental Shelf.

In 1952 Congress passed a quitclaim bill recognizing state ownership of the tidelands. The state limit was to be 3 miles from shore except where Congress had approved a broader belt. President Truman vetoed the bill and it failed to pass over his veto.

The Submerged Lands Act passed Congress in 1953 and was signed by President Dwight D. Eisenhower. This measure quitclaimed to the states a coastal belt extending 3 miles seaward except in the Gulf of Mexico. There, state control was recognized out to "historic" boundaries, but even the gulf limits were not to be more than 3 leagues from shore.

The present case revolves around the location of Louisiana's "historic" boundary. The U. S. contends that state ownership under the Submerged Lands Act does not extend more than 3 miles seaward.

This brings up the touchy matter of locating the actual coast line. In some of South Louisiana's marsh regions even a man on foot can't always be sure whether he's on land or sea; and any decision in the matter would change with the tide.

In addition, there are many bays and other "inland" waters giving Louisiana a ragged shore. Because of the shifting low-water line, Louisiana might not get control over a full 3-league belt even if it wins this case. It could make a lot of difference whether the 3 leagues were measured from the "historic" shore or the present shore.

"When the State of Louisiana became a member of the Union its boundary did not extend into the Gulf of Mexico more than 3 geographic miles from the ordinary low-water mark or from the outer limit of inland waters," Atty. Gen. Herbert Brownell, Jr., contends in the complaint now pending, "and the Congress of the U. S. has never approved a boundary for said state extending into the Gulf of Mexico more than 3 geographic miles. . ."

Brownell argues that the U. S. "is now entitled to exclusive possession of and full dominion and power over the lands, minerals, and other things underlying the Gulf of Mexico" all the way from the 3-mile line to the edge of the Continental Shelf.

The shelf is generally defined as the submerged lands lying under 600 ft. of water or less. At about the 600-ft. mark the gulf bottom drops off abruptly. In some parts of the gulf the shelf extends nearly 150 miles from the mainland.

Louisiana's Position

Louisiana contends that the best way for the U. S. to establish a firm claim to a bigger chunk of the Continental Shelf is to recognize the state's claim. For, according to this logic, the state's boundary coincides with that of the U. S. An extension of the federal boundary would at the same time extend the state boundary.

"Louisiana Tidelands," a booklet published by the office of Louisiana Atty. Gen. Jack P. F. Gremillion, outlines the state's case. In that booklet, Gremillion draws a distinct line between "jurisdiction and control" on the one hand and "title and ownership" on the other.

In the Outer Continental Shelf Lands Act of 1953, Gremillion says, Congress "refused to assert claim of title for the U. S." to the shelf. "Instead, it provided that the **jurisdiction and control** of the U. S. shall extend to the edge of the Continental Shelf.

"If in the future these assertions should be used as bases for the declaration that jurisdiction and control are the same as **title and ownership,** that declaration of boundary by the U. S. would necessarily also extend the boundary of all adjoining states."

Gremillion defiantly argues that failure to recognize that gulfward boundaries of the U. S. and Louisiana are coextensive "would be to create a new kind of ownership."

For, as Louisiana sees it, the U. S. either owns the disputed land or it doesn't. If it doesn't, then its claim to jurisdiction and control over it is a nebulous one.

Louisiana has established claim to several different boundaries.

Spain at one time claimed the entire Gulf of Mexico as an enclosed

sea, state officials note. But in 1682 the French explorer LaSalle took possession of the Louisiana territory. State officials contend that the LaSalle proclamation included the Gulf of Mexico as far south as the 27th parallel. This line is nearly 200 miles south of the present coast. According to state authorities, the same line was recognized when the territory became U. S. property in 1803.

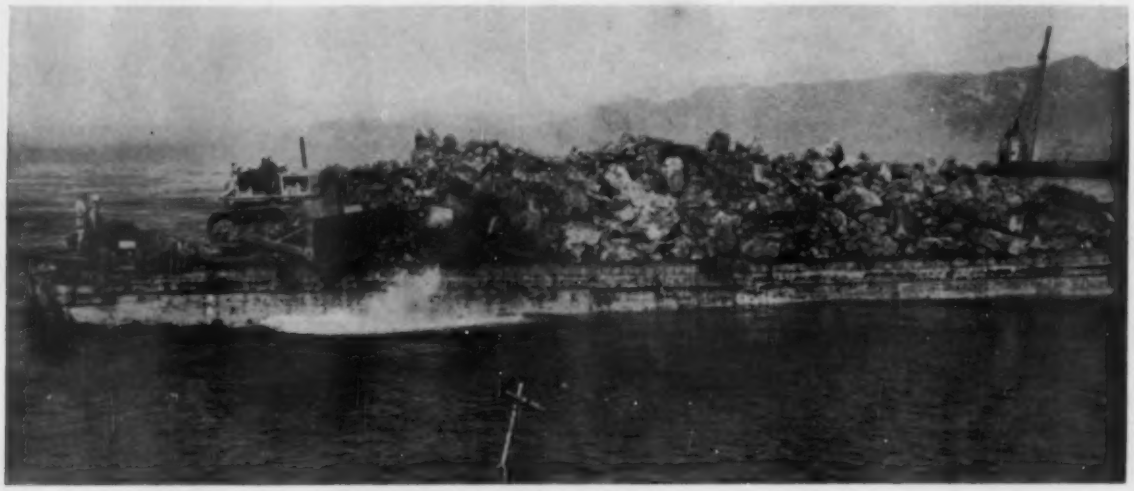
"So," says Gremillion, "if the U. S. should assert its outer boundaries to this extent, then Louisiana's boundary must also extend to that point."

Under Louisiana's interpretation, the state's southern limit was fixed at 3 leagues from the coast when it was admitted to the Union in 1812.

In recent years Louisiana has passed two bills redefining its seaward limits. An act of 1938 declared the line to be 27 miles seaward. This law was repealed in 1954. At the same time the legislature declared the boundary to be 3 leagues beyond the "coast line." This is a line drawn between the so-called inland waters and the open sea.

The state, of course, insists that its coast and its shore are two separate lines. And Gremillion cites congressional authority for such a distinction. He says Congress at one time "authorized a survey to be taken of the **coast** of the U. S., in which was to be designated the islands and shoals, within 20 leagues of any part of the **shores** of the U. S."

Gremillion says Louisiana has exercised continuous sovereignty over the disputed tidelands ever since its admission to the Union. This sovereignty, he charges, was unchallenged until oil was discovered there.



More Than One Way to Skin Cat Off California

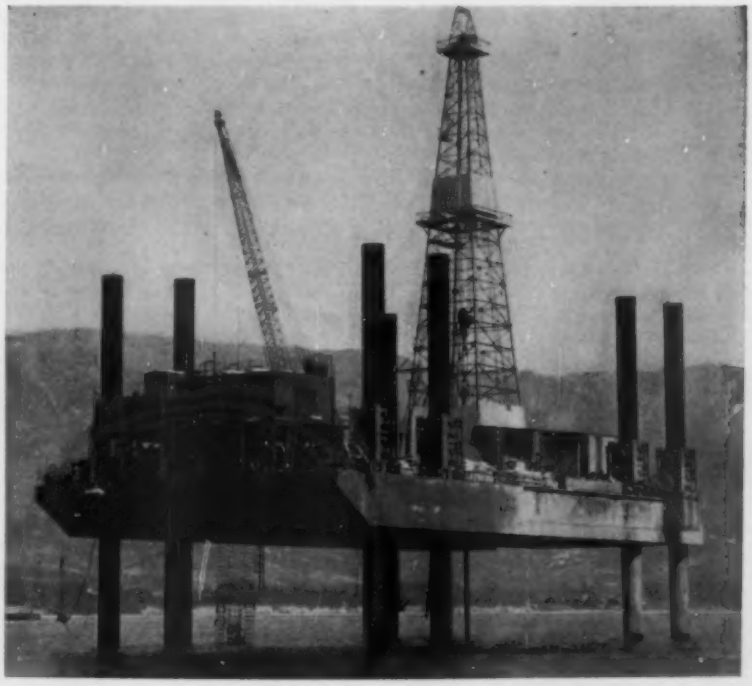
LOS ANGELES. — Two radically different barges are busy on big leases off the California coast.

The flat barge above means there's going to be quite a rock pile in the Pacific. The bulldozer crowding the rim of the barge is dumping rock into 45 ft. of water to build up the first artificial drilling island on Richfield Oil Corp.'s 1,175-acre offshore lease at Rincon, Ventura County.

An estimated 660,000 tons of fill will be used to create a 1-acre working area about 3,000 ft. from shore. The island will be able to handle as many as 70 wells.

In the photo at right, a newcomer to the West Coast has gone to work for Standard Oil Co. of California and Humble Oil & Refining Co. It is Pacific Driller 1, the first gulf-type mobile drilling platform to make an appearance in California waters.

The big platform, costing $2 million and capable of drilling in 100 ft. of water, is testing Socal and Humble's $7¼-million, 5,500-acre wildcat lease off Santa Barbara. Pacific Driller is owned by Offshore Constructors, Inc.



Take depletion, for example . . .

Oil Told to Clean House

WICHITA FALLS, Tex.—An independent refiner told oil men here last week that the industry can't expect public good will until it cleans up its own house.

Speaking before the twenty-seventh annual meeting of the North Texas Oil and Gas Association, Roland Rodman said a blanket defense of the depletion allowance, for instance, is wrong—that columnists and congressmen are right in criticizing the present law because it is being abused.

Rodman, head of Anderson-Prichard Oil Corp., said the guilty parties are the big importing companies. They are applying percentage depletion to foreign production and getting away with it, he said.

This, Rodman declared, is a perversion of the law. The depletion allowance was approved by Congress as an incentive to domestic producers to develop adequate domestic oil reserves.

Importers' use of it for foreign oil is having the exact opposite effect, he said, in that the flood of cheap, tax-free foreign oil is taking more and more of the U. S. market away from domestic producers.

It is little wonder that the depletion allowance is attacked again and again, Rodman said. The attackers see only the tremendous profits made by the giant oil firms primarily on imported crude. They don't look at the profit-and-loss statement of the Wichita Falls independent producer or the independent Oklahoma City refiner.

Rodman charged that importers are using other unethical means of reaping huge profits. He listed these as:

. . . Dodging U. S. income taxes by taking advantage of a loophole in the laws which permits an American firm to charge off against U. S. taxes those taxes it pays to a foreign government on its foreign operations. Importers, he said, now do not pay a penny in income taxes to the U. S. Government on their foreign operations, where they used to pay millions.

Rodman said the change came when the underdeveloped foreign producing countries rightfully insisted on a larger share of the oil take than they were getting from their one-eighth royalty.

The importers, he said, persuaded these countries to impose huge taxes rather than to raise royalties. This way, Rodman said, importers are clearing as much as ever while U. S. taxpayers foot the bill for putting the added money in "the pockets of the Arab kings."

. . . Building their tankers in foreign ports and operating them under foreign flags and with foreign crews.

. . . Maintaining an unrealistic maritime rate.

Via these routes, Rodman said, importers have maneuvered the taxpayer into the threat of wrecking his own high standard of living . . . since a strong domestic oil industry has been the prime base for that high living standard.

Two industries . . . There are now two refining industries in this country, Rodman said . . . those with imported crude and those without.

Unless something is done soon, the latter will go under, he said. They cannot exist when competitors are making the same products from cut-rate foreign crude not available to all.

The Rodman solution . . . To remedy this, the U. S. income-tax and percentage-depletion laws must be amended to remove the abuses by importers, Rodman said.

He suggested also that the Congress might do well to consider a law requiring that oil imports into the U. S. be brought here in "American bottoms with American crews."

Total imports shouldn't exceed the ratio they bore in 1954 to total domestic demand. This volume, Rodman said, should be shared by every refiner in the U. S. on the basis of his runs to stills the previous year.

The Government, he said, could do this by granting import certificates to each refiner for his share. If he didn't want to import the crude, he could sell the certificate to another refiner who did.

Commissioner chimes in . . . Ernest O. Thompson, member of the Texas Railroad Commission, likewise took a punch at imports.

Unless something is done to slow down the influx, he said, "you'll soon find world oil prices being set at the Persian Gulf instead of the Texas Gulf Coast . . . and the domestic producer will be out of business."

Imports, he said, are cornering the domestic market. And it is showing up in Texas in the form of declines in proved reserves in the past 2 years.

The U. S. has to have domestic oil and lots of it if it is to remain a world power.

The Suez crisis, he said, has clearly proved this. It also has shown, he said, that there is an extreme need for a big-inch crude oil line from the gulf to the East Coast.

There are indications that the Government is now convinced of this need and that something may soon be done, Thompson said.

GENERAL THOMPSON told the North Texans a Gulf Coast-East Coast crude line may be built soon. Suez showed the need, and the Government may act, he said.

Wage Pattern Set?

It looks like 5 per cent. That's what Socony is offering, what Aurora settled for and C.S.P.U. says it will take

LABOR'S demand for big oil-industry wage increases, and management's hold-the-line counterproposals are nearing a compromise.

After nearly 4 months of dickering, large and small unions alike are leaning toward accepting wage increases in the neighborhood of 5 per cent. This is equal to about 13½ cents per hour.

Original demand of the big 105,000 Oil, Chemical, and Atomic Workers International Union was 27 cents. The Federation of Independent Oil Unions had sought 25 cents—or 10 per cent.

But management's counterproposals have never exceeded 5 per cent. Here is the picture on the bargaining front:

. . . **The strike against Aurora** Gasoline Co.'s Detroit refinery ended last week after an agreement was announced between the O.C.A.W. and the company.

Basis for the settlement was a reported 5 per cent wage increase. The 42,000-bbl. plant—largest in Michigan—was shut down March 24 when 350 workers walked off their jobs.

. . . **Socony Mobil Oil Co., Inc.,** has offered 5 per cent to striking O.C.A.W. marketing employes in the Detroit area. O.C.A.W.'s powerful bargaining-policy committee is studying the offer.

. . . **Magnolia Petroleum Co.,** Socony subsidiary, gave a 5 per cent wage increase to nonunion employes and made the same offer to unions.

. . . **Central States Petroleum Union** said it would accept a 5 per cent wage increase from Standard Oil Co. (Ind.). The 12,000-member independent union made the announcement after Indiana Standard began pressing a 4 per cent offer.

One independent union has already accepted Indiana Standard's 4 per cent offer: The 6,500-member Independent Petroleum Workers of America at the company's Whiting, Ind., refinery.

Socony's 5 per cent . . . This counterproposal came about a month after Socony marketing employes walked off their jobs in Detroit the latter part of February. Truckdrivers and bulk-plant workers of six other major marketers followed suit, tying up distribution at some terminals in southeastern Michigan.

By late March, an estimated 700 marketing workers were on strike against Socony, Shell Oil Co., Gulf Oil Corp., The Texas Co., Standard Oil Co. (Ind.), Sinclair Oil Corp., and Pure Oil Co.

The marketing strike backwashed to Socony's 30,000-bbl. Trenton refinery south of Detroit *(The Oil and Gas Journal, April 1, page 78).*

The refinery was not strike-bound, but it was forced to cut back runs when products began to pile up because of the marketing strikes.

Gulf Coast's first . . . Magnolia's 5 per cent wage increase was the first offered by a Gulf Coast refiner this year.

The raise applied to about 700 nonunion workers at the 200,000-bbl. refinery at Beaumont, Tex. Most of the other 2,300 workers at Beaumont are members of the O.C.A.W.

Other Magnolia marketing, production, and pipeline workers are represented by O.C.A.W. and the Associated Petroleum Workers.

Offshore Gas Deal Endorsed

WASHINGTON. — A deal which will give Tennessee Gas Transmission Co. 6.4 trillion cubic feet of high-priced Continental Shelf gas over the next 20 years needs only final Federal Power Commission action to go into effect.

Tennessee will buy the gas from the C.A.T.C. group, which is made up of Continental Oil Co., Atlantic Refining Co., Tidewater Oil Co., and Cities Service Production Co. It will be delivered into pipelines not yet built at the group's drilling platforms in the West Cameron, East Cameron, and Vermilion areas off Louisiana.

Initial price for the gas will be 21.4 cents per 1,000 cu. ft. from next November 1, when deliveries are to start, to November 1, 1962. The price will then increase 2 cents per 1,000 cu. ft. with similar increases every 4 years.

Conditional approval . . . Approval of the sale was recommended last month by FPC Examiner Ewing G. Simpson. His decision was conditioned, however, on the granting of a certificate to Tennessee to build the line to carry the gas from the wells to its mainline system.

The FPC has not yet acted on the pipeline application. But if it accepts Simpson's decision, a construction permit will necessarily follow.

The contract will give Tennessee immediate assurance of 2 trillion cubic feet of gas. The producers, however, may dedicate another trillion before August 1, 1958. Thereafter they may set aside up to 400 billion cubic feet a year up to August 1, 1967.

During the first year T.G.T. is to take 175 million cubic feet per day or four-fifths of the maximum efficient rate of flow, whichever is less. Beginning November 1, 1958, Tennessee is to take or pay for one million cubic feet daily for every 8 billion cubic feet of recoverable gas originally in place in the dedicated reserves.

The case was handled quickly by the FPC because of a showing that a decision must be made by April 1 if the line to the leases was to be built for use beginning next November 1.

The examiner's decision is subject to review by the full FPC. But if neither an interested party nor the commission itself secures a review, the decision will become final in 20 days.

Refinery Started

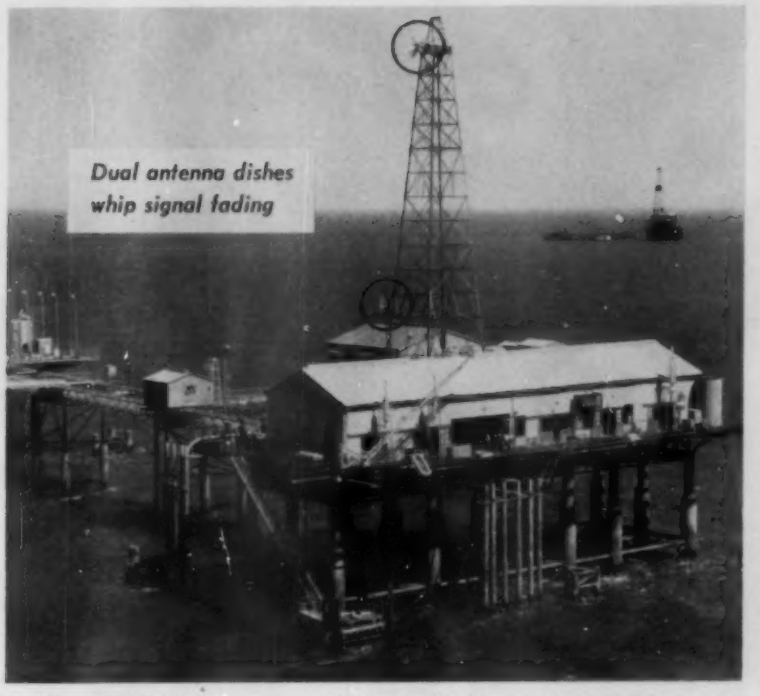
British American building plant in Puget Sound area

VANCOUVER, B. C.—British American Oil Co., Ltd., will join the growing list of companies with refineries in the Pacific Northwest, with construction of a 20,000-bbl. plant at Port Moody 10 miles east of here.

In addition to topping and vacuum facilities, the plant will include catalytic cracking, catalytic reforming, and alkylation units for production of high-octane gasolines.

Contract went to Canadian Kellogg Co., Ltd., and preliminary construction is already under way. Completion is scheduled in late 1958.

The refinery is going up on a 400-acre tract adjacent to British American's Burnaby marketing depot. It will feed the company's 550 dealers and service stations in British Columbia. B.A. has been buying products under a contract that expires during the next 2 years.



CLEAR RECEPTION and more control is now possible in over-water communications as

Offshore Turns to Microwave

DALLAS.—The world's first offshore microwave system is being tested in the Gulf of Mexico off Morgan City, La.

The system covers almost 80 miles in four hops, starting at Morgan City and running through Burns Terminal and on out to Block 51, Block 126, and Block 128 oil fields.

Magnolia Petroleum Co. will operate it for the Magnolia-Continental Oil Co.-Newmont Oil Co. offshore production team.

The system was engineered by Radio Corporation of America and will operate in the 2,000 mc. band. The R.C.A. equipment has a capacity for 30 voice channels. Initially, however, only three channels will be used—two for voice communication and one for control of VHF radio. More likely will be used later for telemetering and control of equipment.

Actual work on installing equipment has been completed, and engineers have been running level tests and otherwise checking out the system for several weeks.

Obstacle hurdled . . . The use of microwave for over-water communication has been restricted in the past by signal fading due to reflection off the water and unusual atmospheric conditions.

Engineers think the new system will whip these problems with its "space diversity" setup. It uses two instead of the normal one parabolic antenna dish—one on top of the tower, the other 70 ft. lower (see photo).

The longest hop on the system is 25 miles from Burns Terminal to Block 51. The others are 21 miles from Morgan City to Burns, 22 miles from Block 51 to Block 126, and 9 miles from Block 126 to Block 128.

Big future offshore . . . Communications experts think there is a big future for microwave because it appears to be the only effective way to communicate offshore — at least in the more prolific oil areas of the tidelands.

VHF radio is too crowded. Stations in the area interfere with each other. Too, operators can't control as many functions as they would like using VHF. And VHF isn't private.

Other oil companies active offshore are encountering the same communications problems as did the Magnolia-Continental-Newmont team.

And you can expect more systems to be sold within the next few months. The big C.A.T.C. group, for instance, has already asked for bids for a large system off the Louisiana coast.

—— *Pipeline* briefs

Hearing on a proposed crude line from southwestern Kansas to Arkansas City, Kans., originally scheduled by the Kansas Corporation Commission March 29, has been delayed until project plans, markets, and supply are firmed up.

Southern Kansas Pipeline, Inc., backed by Aladdin Petroleum Corp., and Anderson - Prichard Oil Corp., proposes a 200-mile, 6-10-in. line to serve northwestern Oklahoma and southwestern Kansas fields which have lost their market *(The Oil and Gas Journal, March 25, page 114)*. Verbal commitments have been received from purchasers who would take most of the 10,000 bbl. daily to be moved by the line.

Texas-New Mexico Pipe Line Co. has started surveying the route of its planned 517-mile 16-in. crude line from Aneth field, Utah, in the Four Corners area, to Jal, N. M. Survey contracts went to J. V. McCoy, Houston, and E. H. Schmidt & Associates, Tulsa. The 50,000-bbl. daily line is expected to get under way late this year and start operations sometime in 1958.

Ohio Fuel Gas Co. has announced a construction program of 204 miles of 4 to 24-in. pipelines, most of it to be completed by the third quarter.

Shell Oil Co. has put all its eastern products-pipeline operations under one roof in a new building in Indianapolis. Vern K. Leonard is general superintendent at the Indianapolis headquarters, which centralizes work of four scattered field offices and the dispatching office recently moved from New York.

Also for Pipeliners . . .

Texas producers lead off in much heralded pipeline-producer battle at Austin (P. 63) . . . World's first offshore microwave system is being tested in gulf by Magnolia (P. 73) . . . U. S. Supreme Court will test states' right to fix prices on interstate gas at wellhead (P. 79) . . . Rathbone opposes making new superinch pipeline in Middle East an international artery (P. 84).

PLUS THESE TECHNICAL FEATURES: Service Pipe Line finds advantages in localizing supervisory control at Fort Laramie station (P. 88) . . . and new methods of welding line pipe outlined in Pipeline Patrol (P. 129).

NEW POOL OPENER near downtown Los Angeles came in recently for Ventura Oil Co. Crews are putting the well back on production after bailing sand. In the background are the Federal Building, City Hall, and County Hall of Justice. They are about 6 blocks away.

Midtown Boom Turns Back the Clock in

LOS ANGELES. — Back in the 1920's this city was caught up in a booming oil-lease play. By the time the boom died away the oil companies had a lot of good prospects under contract, but they had left a lot of others untouched.

Last week the land scouts were out again, trying to finish up the job they had left more than 30 years ago. And interest in their activities has developed to the point where metropolitan daily newspapers have been carrying front-page stories filling readers in on the background of oil and explaining property owners' rights.

The stage for this belated activity was set back in the period between 1900 and 1925 when the oil industry and the expanding city were locked in a tight race. Operators were scrambling to lease attractive areas in the Los Angeles Basin. The fast-growing population was engulfing drill sites.

The race ended in a dead heat. Oil companies made tremendous discoveries in suburban areas such as Wilmington, Inglewood, Santa Fe Springs, Dominguez, Huntington Beach, and Long Beach. But they lost out in many promising areas closer in.

Two factors teamed up to force the oil operator out of these choice locations.

... Acreage became more valuable as homesites than drill sites because of the economics of the oil business at that time.

... Drilling had the reputation of being a noisy, dirty business.

Changing scene . . . Now, however, the situation has been almost completely reversed. Oil in California is at a premium. The state currently imports about 200,000 bbl. daily. Oil in the Los Angeles Basin is particularly attractive because of its proximity to refineries and markets.

Another big change has been in drilling practices. Several operators, notably Union Oil Co., Universal Consolidated Oil Co., and Signal Oil & Gas Co., have made big strides in overcoming opposition to residential drilling.

The companies have soundproofed their drilling rigs, and they have been camouflaging drill sites with eye-appealing landscaping. Green, plastic-clad rigs are becoming common in the basin and are daily gaining public acceptance.

Still another factor in the new push is the record of success operators have been having in reviving old Los Angeles Basin fields with deep drilling.

Here's a rundown of current town-lot activity:

Salt Lake field . . . Morgan Brown, Beverly Hills oil operator, has started a 13,000-ft. test on 43 acres overlying the old shallow-producing area where only eight wells remain (see photo at right).

Located in West Hollywood, the area pushes up against plush restaurant row and includes many high-income dwelling units.

Silver Lake . . . This district, which starts about 2 miles west of the city hall and runs along Sunset Boulevard, has been the scene of an active lease play in recent weeks by Richfield Oil Corp.

Richfield has petitioned the city council for a permit to establish a drilling district here. The company claims to have signed more than 800 leases. The area includes older residential property and takes in the northwest portions of the old Los Angeles field.

Last month, Ventura Oil Co. completed a well on the northwest fringe of the field within howitzer range of the city hall for a new pool opener. The well is making 30 bbl. daily of

SOUNDPROOFED RIG starts a deep test in nearly abandoned Salt Lake field.

Los Angeles

14°-gravity crude from about 1,800 ft. (see photo at left).

Pico-Adams . . . Thirty years ago this neighborhood was one of the swankiest in metropolitan Los Angeles. The area has the only undrilled topographic high in the Los Angeles Basin.

It still includes many fine old mansions. But shortly before World War II, Negroes started moving in and property values fell. Now the area is ripe for development.

About 2 months ago, Union, Signal, and the new firm of Guiberson & Burke started a lease campaign in the neighborhood. Signal claims to be leading the race with more than 4,000 leases.

Movie lots . . . Universal Consolidated has been granted permission to set up a second multiple-well, soundproofed drill site on the Twentieth Century Fox lot on the West Los Angeles-Beverly Hills boundary. Universal has completed 11 wells from the first drill site, which has served as a model for other soundproofing operations.

Union has leased the movie lots of Columbia Pictures, RKO Pictures, and Paramount Studios in the heart of Hollywood. This acreage is about 2 miles west of Richfield's leases in the Silver Lake district.

Signal has leases on the 144-acre Hillcrest Country Club southwest of Twentieth Century Fox and an additional 4 acres of residential property northeast of Hillcrest. The city council recently approved drilling on the city-owned 180-acre Rancho Golf Course next to Twentieth Century Fox.

Some problems . . . In the middle of the boom, however, there are still some problems. A city ordinance requires operators to sign up at least 51 per cent of the property owners in each 40-acre drilling district before application can be made for drilling.

Drill sites must be limited to 2 acres, with only one such site on each 40 acres. Also, each district is limited to one well for every 5 acres. And the usual soundproofing and landscaping regulations apply.

The ordinance contains 60 specific conditions which can be imposed by the zoning commission before drilling can be started.

These problems are topped off with another big one—educating property owners, as well as a good many city officials, to the economics of the oil business. This was pointed up during a city council hearing recently on Richfield's permit to drill in Silver Lake district. A spokesman for property owners said:

"Richfield should get the 12½ per cent royalty, while we get the 87 per cent. After all, we own the oil, not Richfield."

Beefed-Up Premium Spreads

BEEFED-UP premium gasoline is showing up more and more across the country. This is apparent in Ethyl Corp.'s latest monthly survey of gasoline.

The octane count moved up in March, reversing February's slight downward trend. But the most significant change was in the spread of 99-plus. Of the 850 samples taken in 53 cities, 50 samples were of 99 octane or higher. This compares with only 29 samples of 99-plus in February.

The number of 99-plus suppliers more than doubled in March—from four suppliers in February to nine in March.

The supplier with the largest distribution increased its spread of 99-plus octane to 23 of the 53 test cities. This compares with 20 in February. The supplier with the second largest distribution increased its 99-plus territory to 10 cities in March, as compared with 7 in February.

Count climbs . . . February's 0.1 drop in octane numbers was shortlived. National weighted average for premium increased to 97.5 in March, compared with 97.3 the previous month. Regular moved ahead to 90.5, compared with 90.4 in February.

Premium was up 1.1 octane numbers over March of last year. Highest average was 98.7 in Corpus Christi, Tex. Lowest was 94.2 in Billings, Mont., and Salt Lake City. One supplier continued to retail premium of more than 100 counts: 100.2 in Baltimore, and 101.3 in Houston.

Regular was up 1.2 over March of last year.

Extremes of high and low are continuing to lessen. In March of this year the spread between high and low premium averages was 4.5 octane numbers, compared with 4.9 the same month last year. In regular, the spread was only 8.9 this March, compared with 9.5 a year ago.

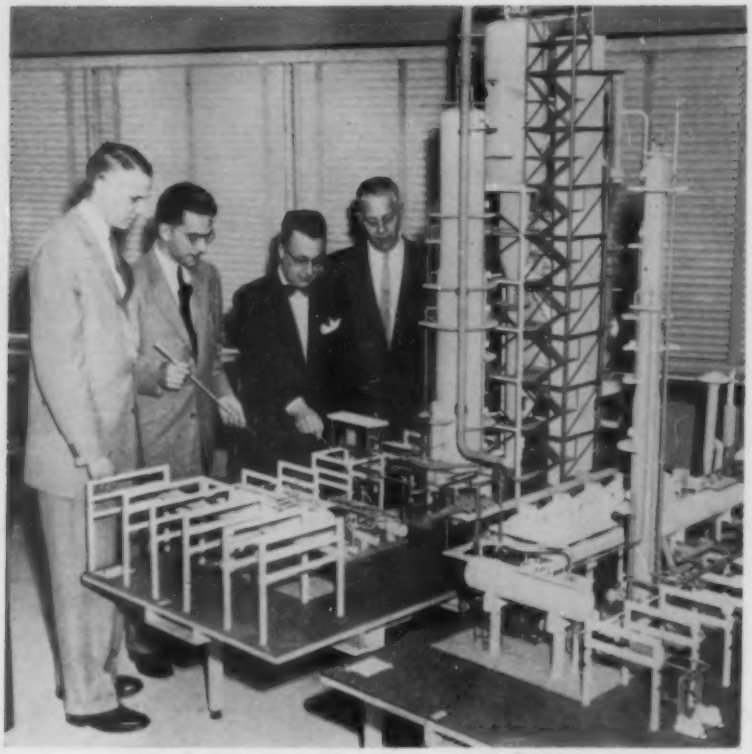
Following is a table of Ethyl's latest survey:

PREMIUM
(Cities per octane group)

Group—	March 1957	February 1957	March 1956
92-92.9	0	0	2
93-93.9	0	0	5
94-94.9	4	4	5
95-95.9	0	1	13
96-96.9	16	18	10
97-97.9	13	18	18
98-98.9	20	12	0
Total cities	53	53	53
Wanted avg. R.O.N.	97.5	97.3	96.4
Wanted avg. TEL, ml./gal.	2.52	2.47	2.39

REGULAR
(Cities per octane group)

Group—	March 1957	February 1957	March 1956
82-82.9	0	0	1
83-83.9	1	1	0
84-84.9	0	0	1
85-85.9	1	1	3
86-86.9	3	7	15
87-87.9	8	4	2
88-88.9	8	7	4
89-89.9	10	13	12
90-90.9	6	3	5
91-91.9	7	9	9
92-92.9	9	8	1
Total cities	53	53	53
Wanted avg. R.O.N.	90.5	90.4	89.3
Wanted avg. TEL, ml./gal.	2.00	2.02	1.96



Plant Within a Plant Breaks Ground

TOLEDO. — Construction was started last week on the 60,000-bbl. Toledo refinery of Standard Oil Co. (Ohio).

Sohio men getting a preview of how part of the plant will look are, from left, George C. Knapp, project coordinator of new facilities; Edward N. Marsh, head of the process engineering division; Howard F. West, head of the general engineering division; and I. L. Peterson, manager of the Toledo refinery. The complete model of the plant is 35 ft. square.

The plant is being built on the grounds of Sohio's old 31,000-bbl. plant, most of which will go into mothballs. The new facilities will have atmospheric and vacuum crude distillation, delayed coking, catalytic cracking, hydrogenation, catalytic polymerization, catalytic reforming, gasoline recovery and stabilization, treating and continuous gasoline blending, and steam generation.

Products will include solvent naphthas, automotive and aviation gasolines, jet fuel, kerosine, furnace oil, diesel fuel, heavy fuel oil, and petroleum coke. Completion is scheduled for April 1958. M. W. Kellogg Co. has the prime contract.

Venezuelan Imports Spiral

CRUDE imports from Venezuela set an all-time record in January to help boost total crude imports above averages for December and January 1956.

Total crude from Venezuela averaged 619,000 bbl. daily, including 6,600 bbl. daily listed as coming from Netherland Antilles but which probably originated in Venezuela. The total does not include 21,800 bbl. daily sent to Puerto Rico. These figures are from the latest report by the Census Bureau.

Crude from Canada also set a new record. The average for January was 187,200 bbl. daily compared with 159,900 bbl. daily in December. Of this total, 36,100 bbl. daily went to California, 77,000 bbl. daily to Washington, and 74,100 bbl. daily to the Great Lakes area.

Crude from the Middle East dropped to the lowest level since late 1951. January receipts from the entire area averaged 47,500 bbl. daily. This total was made up from 28,500 bbl. daily from Kuwait, 10,100 bbl. daily from the Neutral Zone, and 8,900 bbl. daily from Iran.

Product imports averaged 612,400 bbl. daily in January. This was a little higher than the December average but slightly less than for January 1956.

Total exports dropped to 795,200 bbl. daily in January from 924,600 bbl. daily in December. The largest drop was in shipments of crude, down almost 100,000 bbl. daily. Distillate exports were reduced about 40,000 bbl. daily, but residual showed a gain of 26,600 bbl. daily.

IMPORTS INTO CONTINENTAL U. S.
(Thousands of barrels)

	Jan. 1957	Dec. 1956	Jan. 1956
Crude—			
Mexico	597	509	416
Colombia	878	501	885
Venezuela	19,199	13,425	12,361
Peru			122
Ecuador			64
Kuwait	885	2,897	3,291
Saudi Arabia		739	1,667
Neutral Zone	312	498	419
Iraq		222	962
Iran	276	415	326
Qatar			238
Canada	5,802	4,957	3,428
Far East	1,055	1,319	845
Total crude	29,004	25,482	25,024
Daily average	936	822	807
Products—			
Residual fuel	17,556	17,482	18,218
Other products	1,428	961	1,363
Total products	18,984	18,443	19,581
Daily average	612	595	632
Total all oils	47,988	43,925	44,605
Daily average	1,548	1,417	1,439

EXPORTS*

	Jan. 1957	Dec. 1956	Jan. 1956
Crude	7,460	10,544	994
Gasoline	3,675	4,172	2,250
Kerosine	1,058	659	176
Distillate	6,670	7,906	1,516
Residual	3,869	3,045	1,160
Lube oils	901	1,203	1,017
Other products	1,017	1,134	987
Total all oils	24,650	28,663	8,100
Daily average	795	925	261

*Excludes shipments to territories.

C.A.T.C. Adds Tender

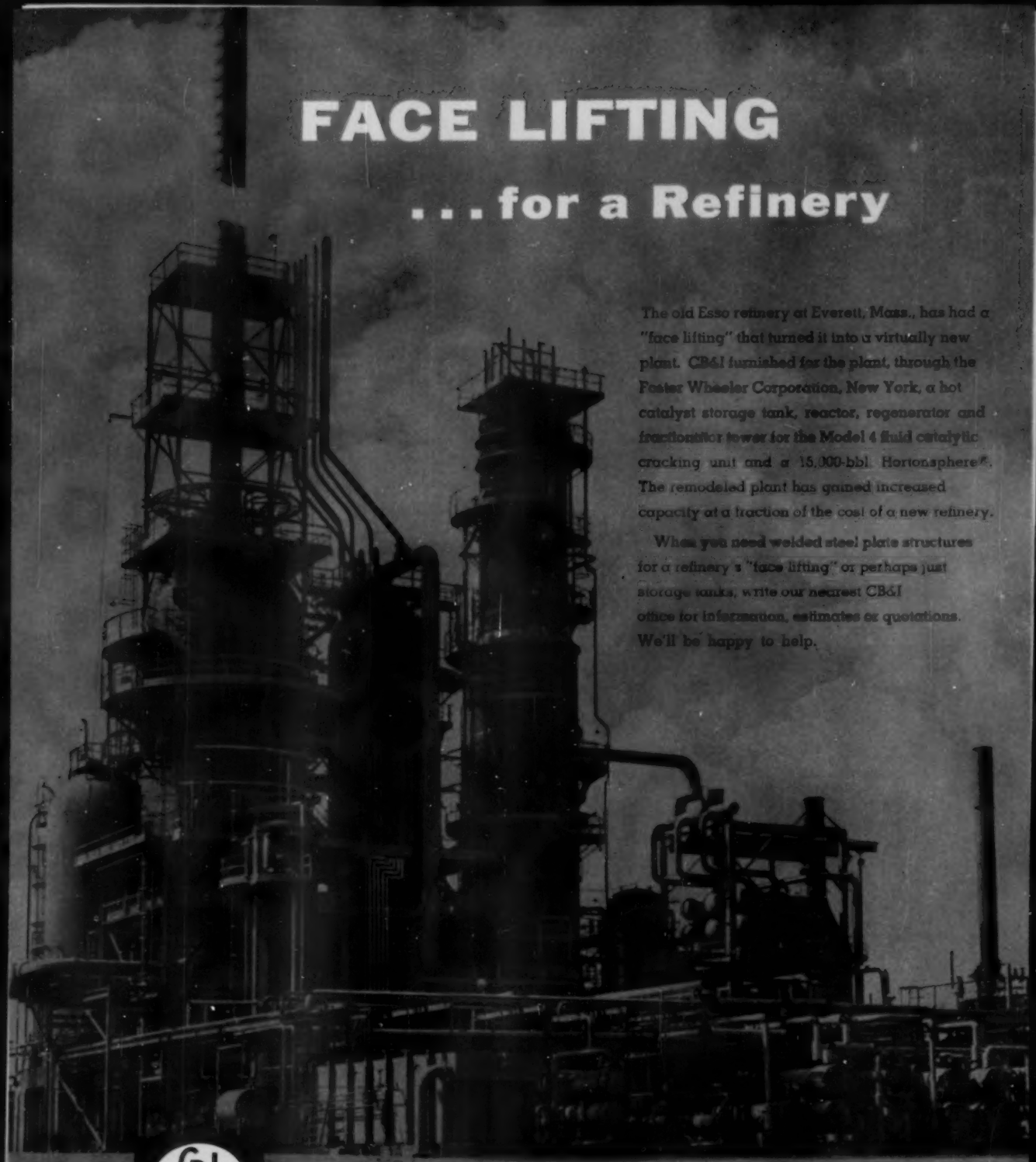
ORANGE, Tex. —A $1,700,000 drilling tender has joined the offshore fleet of the C.A.T.C. Group.

The vessel is the fifth of its kind built for the four-company combine, composed of Continental Oil Co., Atlantic Refining Co., Tidewater Oil Co., and Cities Service Production Co.

The new tender, built by Levingston Shipbuilding Co., was christened the "Orville Fisher" after the Conoco vice president. Measuring 260 ft. in length and 54 ft. width, the vessel will house 50 men. It is designed for waters from 15 to 100 ft. deep.

FACE LIFTING

. . . for a Refinery



The old Esso refinery at Everett, Mass., has had a "face lifting" that turned it into a virtually new plant. CB&I furnished for the plant, through the Foster Wheeler Corporation, New York, a hot catalyst storage tank, reactor, regenerator and fractionator tower for the Model 4 fluid catalytic cracking unit and a 15,000-bbl. Hortonsphere®. The remodeled plant has gained increased capacity at a fraction of the cost of a new refinery.

When you need welded steel plate structures for a refinery's "face lifting" or perhaps just storage tanks, write our nearest CB&I office for information, estimates or quotations. We'll be happy to help.

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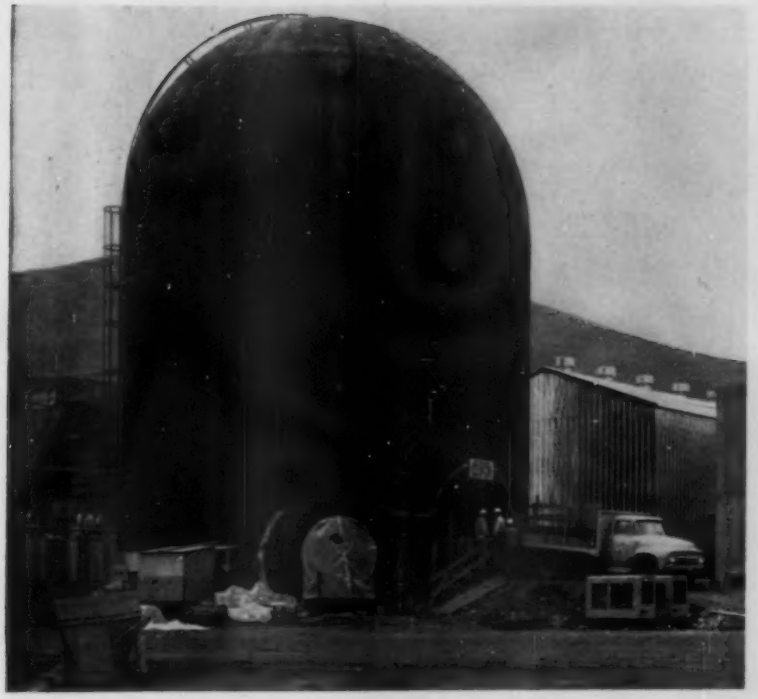


Private Atomic Power Plant Rises

SAN FRANCISCO — The world's first privately owned and financed atomic power plant, shown above, is nearing completion at Vallecitos near here. It is being built for General Electric Co. by Bechtel Corp.

The project really includes two facilities: An electric generating plant and atomic lab.

The boiling-water reactor is shown in foreground. It is housed in a steel capsule 48 ft. in diameter and 100 ft. high. The base is 35 ft. below ground. Walls are ¾-in. thick and encased with 5-ft. thick concrete.

The reactor will supply steam to a Pacific Gas & Electric Co. 5,000-kw. turbine generator. Completion is due later this year.

The atomic lab will be completed in May. It will contain critical-experiment and radioactive-materials units. First experiments there will gather operational data for use on a full scale commercial atomic-electric plant and for training future atomic-power crews.

G.E., Commonwealth Edison Co., and the Nuclear Power Group plan a commercial plant later at Dresden near Chicago. Bechtel also will engineer and build that facility.

After a 14 per cent saving . . .

Humble Likes Slim-Hole Future

WICHITA FALLS, Tex.—The industry may soon be completing development holes with bores as small as 4 in. in diameter.

This prediction is based on a large-scale slim-hole drilling program which Humble Oil & Refining Co. has been carrying out since the early 1950's.

By the first of this year, the company had drilled 304 slim holes, and had saved 14 per cent in casing and other materials, and by using lighter equipment. The deepest well in the program was 10,824 ft.

The results of the program were outlined at the annual meeting of the North Texas Oil and Gas Association by G. E. Cannon and R. A. Watson.

Humble was the first company to actually complete slim-hole wells using 3½ to 5-in. o.d. production casing. In the early stages of the program, these slim holes were exploratory tests. If production was found, either the small hole was reamed or an adjacent regular-size well was drilled.

Humble found that:

. . . **Drilling time** for slim holes was comparable to that for regular-size wells in most cases.

. . . **Labor charges** are cut by using portable-type rigs. Four and even three-man crews can and are being used.

. . . **Air and gas drilling** are adaptable to small-hole techniques. Friction loss due to small drill pipe is less than with mud.

Economics of small-holing are improving, the Humble engineers said, as equipment manufacturers continue to develop rigs, bits, pumps, drill tubing joints, coring and logging equipment, perforating guns, packers, wellheads, and other items designed especially for small holes.

One highly important requirement, they said, is for greater mud-pump horsepower and mud-circulating pressure than usually needed with mud drilling. Higher friction losses due to the smaller drill pipe is the reason.

5,000 City Leases Sought

BAKERSFIELD.—Union Oil Co. wants to look for oil under south and southwest Bakersfield.

Union last week mailed 5,000 lease forms to property owners in a 2,600-acre residential district. It is the city's first major town-lot leasing project.

The company is not asking for surface use of any property; it plans to slant holes from sites outside the residential district. Rigs would be soundproofed and the sites landscaped.

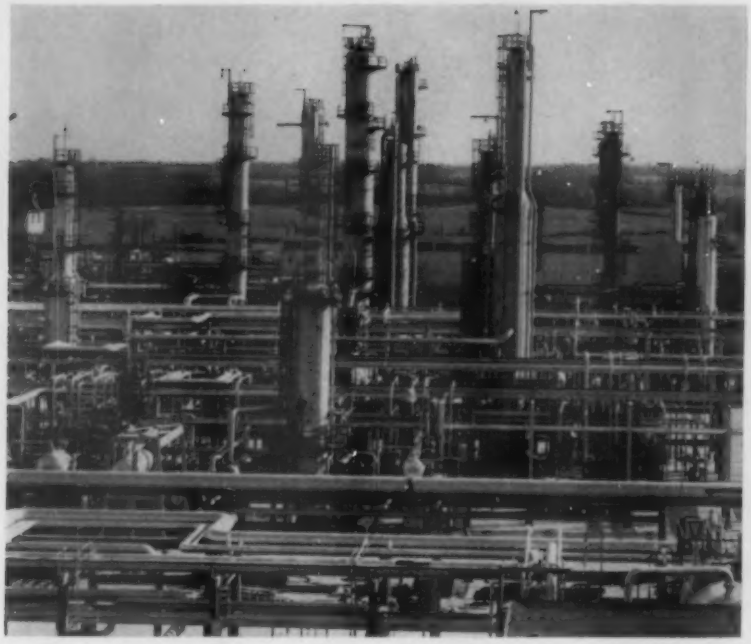
Union explained that for royalty payments, the area would be broken into 160-acre parcels and payments made equally among owners in the various parcels. Union offered to pay an initial fee of $10 plus 2 years' rent in advance for each lease.

Gas-Pricing Order Appealed

WASHINGTON.—States' rights to fix prices on interstate gas at the wellhead will be tested in the U. S. Supreme Court.

Cities Service Gas Co. of Oklahoma City has filed an appeal from a Kansas Supreme Court ruling on the matter *(The Oil and Gas Journal, December 10, 1956, page 86)*. The Kansas Corporation Commission must file a response to the appeal by April 10.

The Kansas court upheld the state in setting a minimum price of 11 cents per 1,000 cu. ft. for gas produced in the Kansas section of Hugoton field. The commission contends it can legally set minimum prices in order to prevent waste. Cities Service claims the Federal Power Commission, not the state, has jurisdiction over gas going into interstate commerce.



At Tidewater's New Plant . . .

. . . Another Record Unit Ready

DELAWARE CITY, Del. — The world's largest hydrodesulfurization plant is now on stream at Tidewater Oil Co.'s new 130,000-bbl. refinery here. It includes five separate, parallel Unifining units which will upgrade 88,000 bbl. of distillates daily.

The units will desulfurize gasoline, jet fuel, kerosine, and domestic heating oils, and will decrease gum formation in gasolines and heating oils.

Hydrogen from the 45,000-bbl. Houdriformer at the refinery will furnish much of the new units' requirements. But it will need more. Hydrogen manufacture from light distillates will supplement the supply. The hydrogen sulfide, formed from sulfur compounds in the refinery streams, will be extracted and processed for elemental sulfur recovery in still another plant in the refinery.

Delaware's seventh unit . . . The desulfurizer complex is the seventh operating unit to be placed on stream at the Delaware refinery.

It was designed and built by C. F. Braun & Co. Universal Oil Products Co. is licensor of the process. The plant comprises about 120 vessels, exchangers, and pumps; nine columns; eight compressors; nine fired heaters; and seven reactors.

The giant Houdriformer was also built by Braun, and licensed by Houdry Process Corp. It will operate on a wide range of feed stocks, primarily from Middle East crudes.

Reformate will be split in an aromatics extraction unit operating on the Udex process, licensed by U.O.P. A recycled stream of raffinate from this unit will be mixed with fresh feed to the Houdriformer.

The reformer will use Houdry's 3-D platinum catalyst, and the design incorporates in-place catalyst regeneration facilities. Production of 100-plus octane clear motor fuel blending stock will be produced in this combination, which Houdry terms Iso-plus.

Oil-Marketing Probe Begins

WASHINGTON. — Another investigation of oil-industry activities will begin this week. A House small-business subcommittee will open a 2-month series of hearings on the marketing policies of major companies.

Chairman of the subcommittee is Rep. James Roosevelt of California, sponsor of a bill to divorce service stations from other branches of the industry.

After 4 days of hearings in Washington this week, the subcommittee will go into the field. Hearings are scheduled in Denver April 16; Los Angeles, April 24-26; Chicago, April 30-May 1; St. Louis, May 13; Cleveland, May 18, and Houston, May 25.

—— *Industry* briefs

A drilling program in Vermont has been started by Maquam Gas & Oil Development Corp. The firm has spudded one well near St. Albans in the northwest corner of the state near Lake Champlain and plans three other wildcats later.

Kansas has passed a 1 per cent severance privilege tax. Gov. George Docking has said he will sign the bill, which covers both operating and royalty production at the wellhead. Bills calling for a 2 per cent tax were killed earlier in the session. One was tabled by a joint committee after winning a vote of approval from the senate.

Crescent Corp. has paid $1,750,000 for a three-eighths working interest in about 1,960 producing acres in the Haynes field of Cass and Marion counties, East Texas. The property was owned by Sam Sklar and others. The deal includes an interest in 46 oil wells and 1 gas well with daily net production of 610 bbl. Most of the remaining interest already was owned by Crescent.

Merger of Trans Empire Oils, Ltd., and West Canadian Petroleums, Ltd., has been completed. The merged company will be known as Trans Empire with offices in Calgary. In the deal West Canadian stockholders received about 62 per cent of Trans Empire shares outstanding. The company owns interest in more than 150 producing oil wells in Canada with net production of 3,000 bbl. daily and a share in more than 750,000 net acres of nonproducing lands.

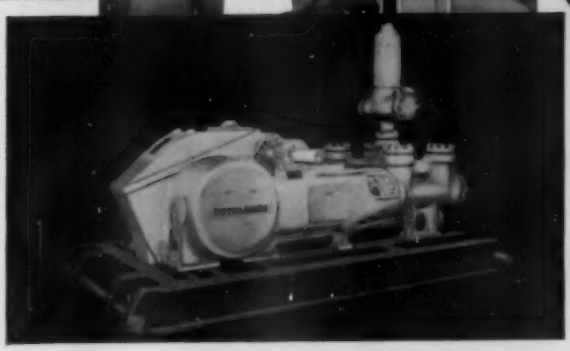
Standard Oil Co. of California, Western Operations, will extend its El Segundo submarine tanker-loading line about 2,000 ft. further into the Pacific Ocean. This will put the anchoring area in 65 ft. of water instead of the current 50 ft. Work will be completed about June 1.

Thomas Jordan, Inc., of New Orleans will explore approximately 250,000 acres in the Cumberland basin area of Nova Scotia. Rodgers and Seglund Associates, also of New Orleans, will act as exploration and development consultants.

There has been little drilling in the area, but commercial production has been established in one shallow oil and gas field near Moncton, New Brunswick.

Pressures

to meet the needs of modern jet drilling



Ever stop to think how a pump can aid the bit in making hole? Since it supplies the high pressures needed in modern jet drilling, the pump is more than just a means of circulating the mud. It makes possible those high-velocity jets at the bottom of the hole, which actually supplement the cutting action of the bit.

As is well known throughout the oil fields, Bethlehem slush pumps are perfect for this kind of service. They can be run for indefinite periods at full-load rating. They can be counted on to keep the pressure at proper levels, whether the hole is shallow or deep. They can, and do, keep "pouring it on."

For this heavy-duty service, outstanding mechanical features are required. Bethlehem slush pumps have them in abundance. Perhaps the most important is the flood lubrication of the power end—a system which is in action with the first turn of the gears. The oil bath operates perfectly at all speeds, high and low. Provision of an oversized reservoir in every model assures an ample store of lubricant.

Other features include high-capacity roller bearings throughout; husky all-steel fluid end, easily serviced; and forged-and-rolled gear rim, which is replaceable in the field. This is only a partial list, of course; there are still other points that merit careful study by the prospective buyer.

You and your engineers are invited to see these dependable pumps. They're built for the pressures you need, and for great reserves of power. Why not let our nearest office arrange for you to watch them in action?

Five Sizes of Bethlehem High-Pressure Slush Pumps

Model	Bore & Stroke	Input Hp
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G-35	8 x 14	350
G-45	8 x 16	450
G-65	8 x 16	650
G-85	8 x 18	850

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Gulf Enters New Field

● Purchase of interest in Callery Chemical puts oil firm squarely in forefront of new high-energy synthetic fuels

PITTSBURGH. — The oil industry took a mild new interest in high-energy synthetic fuels last week on the heels of this development: Gulf Oil Corp. announced it is entering the field.

Gulf officials say the company proposes to be in the forefront of new work in the alkyl boranes by purchasing a 25 per cent interest in Callery Chemical Co. Gulf also plans a joint research program with Callery's parent, Mine Safety Appliances Co.

Callery Chemical is now building a $38-million plant under Navy contract at Muskogee, Okla., to produce a high B.t.u. fuel named HiCal. Production is expected to begin some time next year.

What it is . . . Exact composition of HiCal has been kept a secret by the Navy.

But this much is known: It's a combination of boron, carbon, and hydrogen. In this fashion the great heat and combustion potential of hydrogen gas is locked in a liquid form. Boron is the most efficient carrier of hydrogen—and it also burns with a high heat. The carbon primarily acts as a stabilizer. It permits safe handling and use of the fuel.

The resulting fuel has an extremely high-energy output. It has 50 per cent more energy per gallon than petroleum-based fuels. It burns with a bright green flame and keeps burning at high altitudes where present jet fuels tend to sputter and go out in thin air.

This has prompted military aviation officials to predict the new fuel will power jet aircraft and missiles to new peaks of efficiency. The greater energy can extend range of a plane, reduce weight of the airframe, increase the payload, and improve tactical performance.

HiCal actually is the first of a wide range of new fuels being brought to the production stage by military agencies. The Air Force is known to be developing fuels from a variety of substances including light metals. Researchers report they all have similar advantages in jet planes and guided missiles.

A threat to oil? . . . Sources in the oil industry, in assessing the high-energy fuels as competition, believe they will:

. . . Remain strictly supplementary to petroleum-based fuels for the near future.

. . . Remain in the military for some time to come.

These private observations are based on several factors:

. . . Turboprop or jet commercial aircraft now building or planned are not designed for this fuel. All will use either the kerosine or JP-type light distillates.

. . . Conventional automobile engines do not offer much promise as a field for the high-energy fuels. However, it's possible the fuels may be used in turbine-powered motor vehicles.

The high-energy fuels will bear close watching, but researchers insist they post no threat to petroleum fuels now or for several years to come.

Royalty Increased

New Saskatchewan formula is 3 to 4 per cent higher

REGINA.—The Saskatchewan Government has slightly increased the royalties on oil and gas production from crown-owned rights.

The new formula for royalties results in an increase of between 3 and 4 per cent over the old rates. However, the royalties still are slightly below those claimed by the Alberta Government.

The new schedule based on monthly production rates provides for:

. . . 600 bbl. or less—5 per cent of production.

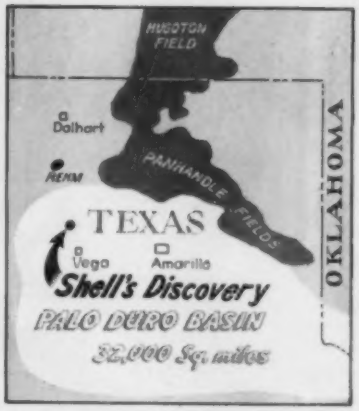
. . . 601 to 900 bbl.—30 bbl. plus 13 per cent of production in excess of 600 bbl.

. . . 901 to 1,500 bbl.—69 bbl. plus 17 per cent of production in excess of 900 bbl.

. . . 1,501 to 4,950 bbl.—171 bbl. plus 18 per cent of production in excess of 1,500 bbl.

. . . More than 4,950—16 per cent of production. This is the maximum percentage of royalties.

The royalty on natural gas is set at 8 per cent of production with a minimum of ½ cent per M.c.f.



Texas Test Hits

Wildcat indicates first oil from big Palo Duro basin

VEGA, Tex.—Shell Oil Co. apparently has opened a new basin in the Texas Panhandle.

The company's 1 Alamosa Ranch, 14 miles north of here in rugged Palo Duro basin, has recovered 4,000 ft. of 40-gravity oil and 500 ft. of heavily oil-cut mud on a drill-stem test in chalky Pennsylvanian lime at 6,095-6,130 ft. Gas tested 76 M.c.f. per day.

In a second test at 6,129-55 ft., the operator failed to get a show. Shell plans to take the well to the pre-Cambrian or 7,000 ft.

Successful completion of the Oldham County wildcat would bring oil to the last of three basins in the Texas Panhandle. Nearest production to 1 Alamosa Ranch is about 40 miles to the north in Hartley County's Rehm field, which opened Dalhart basin.

Shell owns 112,000 acres of Palo Duro basin in the vicinity of 1 Alamosa. But the test is on a 97,000-acre block held by Hunt Oil Co. on Alamosa and Green ranches.

Farmout deal . . . In a deal with Hunt, Shell has an option to drill three wildcats on the Hunt acreage. If all three tests hit, Shell will get 30,000 acres from Hunt.

Here's the way it works; Shell will get 10,000 acres in a checkerboard pattern around each wildcat. An oil producer will give Shell 160 acres around the drill site, a gas producer 640. The remainder of the 10,000 acres will be split up in 160-acre tracts.

Palo Duro basin is one of the least-tested areas in the nation. The subsurface is studded with Permian and pre-Permian rocks up to 11,000 ft. thick. But despite the rough going, the basin looks good. And Shell's

wildcat could set off an intensive search in one of Texas' last exploratory frontiers.

Palo Duro is flanked by big buried domes and anticlines. It lies between two of the most productive areas in Texas—Anadarko and Panhandle fields to the northeast and prolific Permian basin to the south.

Refiners to Meet

A.P.I. agenda spotlights future engines and fuels

NEW YORK.—Fuels of the future and how to make them will take the center of attention at the midyear meeting of the American Petroleum Institute's Division of Refining in Philadelphia, May 13-16.

Interest will also be focused on corrosion encountered in catalytic reformers, air pollution, analytical research electrical equipment, handling of kerosine, instrumentation, and training.

In a special study, Humble Oil & Refining Co. will outline steps necessary for a small integrated refinery to stretch its premium gasoline rating from 98 to 110 R.O.N.

How these superoctane fuels will operate in future engines will also be covered. Ethyl Corp. will reveal new data on matching gasoline antiknock performance and future engines. Further light on the road octane ratings of gasolines in tomorrow's cars will be shed by authors with E. I. du Pont de Nemours & Co., Inc.

Isomerization . . . One of the principal new techniques for gaining higher octane ratings is isomerization. This coming operation will be thoroughly discussed in papers dealing with the Isomate, Pentafining, Iso-Kel and Penex processes.

Houdry Process Corp. will discuss the upgrading of pentanes by isomerization, thermal reforming and catalytic dehydrogenation. A second Houdry paper will cover paraffins in the C_6-C_8 range, proposing octane improvement by dehydrogenative reforming to aromatics and olefins. The session will close with an Humble paper on regenerative platinum-catalyst reforming.

Corrosion . . . This year, the session on corrosion will deal with problems encountered in catalytic reforming. The lead-off paper is a panel report of the subcommittee on corrosion, covering experience of 31 companies with hydrogen sulfide attack in cat reforming and hydrodesulfurizing units.

Processing briefs

Gonzalez Chemical Industries has officially opened its new synthetic anhydrous ammonia plant in Puerto Rico. The $12,250,000 plant has a capacity of 40,000 tons of ammonia per year. The plant uses the Texaco synthesis gas process for producing hydrogen from heavy Venezuelan fuel oil. Some of the ammonia will be charged to a separate plant to make 130,000 tons of ammonium sulfate. The plant also includes a 115,-000-ton sulfuric acid plant.

Two other plants make hydrogen from heavy fuel oil by the Texaco process. They are the Paimboeuf, France plant of Establissments Kuhlmann and Northern Chemicals Industries of Searsport, Me.

Shell Oil Co. has started up a third U.O.P. Platformer at its Wood River, Ill., refinery. The new 16,000-bbl. daily unit gives Shell a 36,000-bbl.-daily Platforming capacity at Wood River, the largest concentration of such units in any refinery.

La Gloria Oil & Gas Co. has completed the purchase of McMurrey Refining Co. and McMurrey Pipe Line Co. of Tyler, Tex. The deal puts La Gloria, primarily a producer and natural-gas processor, in the refining business. McMurrey has a 22,500-bbl. refinery at Tyler. La Gloria does not plan to enter the retail business and will continue to operate the Tyler plant as a custom refinery.

Largest U.O.P. Rexforming unit yet built has gone on stream at Cities Service Oil Co. refinery at Ponca City, Okla. The 6,000-bbl. daily unit, the third ever built, is designed to produce a 95 clear octane debutanized Rexformate for use as a gasoline-blending component.

Vickers Petroleum Co., Inc., of Wichita, Kans., is building a $2-million U.O.P. Udex extraction unit at its 18,000-bbl. Potwin refinery. The unit will turn out 357,140 bbl. of chemicals a year, extracting aromatic hydrocarbons from a catalytic reformer now under construction at the Vickers plant. Products will include benzene, toluene, xylene, and aromatics classified as having 9 to 11 atoms. Procon, Inc., will build the Udex unit, scheduled for completion in January 1958.

The Texas Co. has put a new viscosity breaker on stream at its Eagle Point Works at Westville, N. J. The capacity of the new unit is 13,000 bbl. of vacuum residuum daily. The unit will permit higher yields of furnace oil and reduced yields of residual fuel oil.

Jefferson Lake Sulphur Co. plans to build a big plant just east of Calgary. In a farmout deal with Mobil Oil of Canada, Ltd., the company obtained rights to develop an 80,000-acre tract. Mobil has already drilled three wells in the farmout area. The sour gas contained 12 tons of sulfur per 1,000 M.c.f.

Jefferson Lake is one of the world's largest producers of sulfur. The firm is also building a sulfur extraction, gas-scrubbing plant at Taylor Flats, B. C. This plant, with a 300-ton daily capacity, will process gas before delivery to Westcoast Transmission Co., Ltd.

Also for Refiners . . .

The wage pattern probably will be a 5 per cent increase for refinery workers and other unionized oil-industry employes (P. 72) . . . British American starts construction of 20,000-bbl. refinery in Puget Sound area (P. 72) . . . Beefed-up premium gasoline is showing up at more and more stations over the country (P. 75) . . . Work has started on Ohio Standard's 60,000-bbl. refinery at Toledo . . . Crude imports from Venezuela and Canada to U. S. refineries are setting new records (P. 76) . . . World's first privately owned and financed atomic power plant is nearing completion (P. 79) . . . Another record unit—biggest hydrodesulfurization plant in world—has gone on stream at Tidewater's Delaware City refinery (P. 80) . . . Gulf is entering the field of high-energy synthetic fuels with purchase of interest in Callery Chemical Co. Refiners are warned this field will bear watching (P. 82) . . . Future engines and fuels will highlight program for Philadelphia meeting of A.P.I. Division of Refining (P. 83) .

PLUS THESE TECHNICAL FEATURES: Case histories point up problems, and their solutions, in handling acid in alkylation (P. 93) . . . Zinc coatings are making steel last longer—and they are inexpensive, too (P. 106) . . . The Foreman's Page (P. 119) . . . Equipment design and operation (P. 121) . . . PETROdatics (P. 123) . . . and Questions on technology (P. 127).

"Treaty Line" Rejected

Rathbone opposes making new superinch Middle East pipeline an international artery; he prefers private deal

THE new superinch Middle East pipeline will not be an "international" artery if the world's biggest oil company has anything to say about it.

That was made very plain last week by Monroe J. Rathbone, president of Standard Oil Co. (New Jersey). On his return to New York from week-long conferences in London, Rathbone took sharp issue with the international concept of the pipeline as expressed a few days before by John Foster Dulles, U. S. Secretary of State.

The Jersey Standard president described the pipeline as "definitely a private type of investment." He said the only governmental relationship desired by the eight companies discussing the line is recognition of their right to build and operate it.

Rathbone gave what are probably the most concrete cost and capacity figures mentioned yet. He said the line would carry from 850,000 to 1,000,000 bbl. daily and would cost about $800,000,000. The pipeline will be the biggest yet built to carry crude. Rathbone said only that it will be "bigger than 33-in." lending weight to the informal discussions of at least a 40-in. line.

The Jersey Standard president made his comments in New York Harbor aboard the liner United States. He was returning to this country from the London talks with top executives of British Petroleum Co., Ltd., the Royal Dutch-Shell group, Cie. Francaise des Petroles, The Texas Co., Gulf Oil Corp., Standard Oil Co. of California, and Socony Mobil Oil Co., Inc. The eight companies met for "exploratory" talks about building the mammoth pipeline *(The Oil and Gas Journal, March 25, page 117)*.

Rathbone said committees are working on legal, financial, and operational problems that building the line would entail. A second meeting is slated in 6 weeks to consider the committee reports.

He said all eight companies will participate in the cost of building the line and all eight will share in its use. He said the Middle East terminus of the line would be somewhere near the head of the Persian Gulf and that Iran, Iraq, Kuwait, and Saudi Arabia could all make use of the line. All eight companies have extensive interests in Middle East oil production. Rathbone's company itself has an interest in the operations in Iran, Iraq, and Saudi Arabia.

He said it will take from 3 to 4 years to build the line, depending on getting the pipe. Final plans and complete agreement between the eight companies should be wound up before the end of this year, he said.

The Dulles view . . . It was just a few days before Rathbone's return to this country that the U. S. Secretary of State told Washington newsmen the proposed pipeline probably should have some international status.

He hinted pretty strongly that both the U. S. and Britain were ready to head a movement to have it protected on a treaty basis *(The Oil and Gas Journal, April 1, page 95)*.

Rathbone's reaction to this was stated very simply, "We certainly do not contemplate the project at all as an international pipeline."

Dulles has compared such a pipeline to the Suez Canal and mentioned an international treaty similar to the one that supposedly protected the canal in this respect.

Pipeline versus the canal . . . A pipeline like the one being discussed would carry twice the oil that present Middle East pipeline systems move.

Rathbone conceded last week that it would probably have "some downward effect" on the Suez Canal traffic at first. He pointed out that the line is a long-range project.

"We can see a need for means of transportation of a very large amount of oil from the Middle East to the West," he said.

14 Concessions Now Official

FOURTEEN new concessions in Venezuela totaling more than 240,000 hectares (a little more than 594,000 acres) have shifted from the rumor stage into the official column.

Applications for all 14 have appeared in Venezuela's Gaceta Oficial. This, in effect, is an award of the acreage. Under the bidding regulations set up by the Ministry of Mines and Hydrocarbons the 14 companies involved have already posted the bonuses they offered for these tracts.

With the exception of one area of 40,000 hectares in the State of Tachira in extreme southwestern Venezuela, the successful bidders for the concessions had already become known *(The Oil and Gas Journal, March 25, page 118)*. Applications for the remaining concessions awarded are being published in the Gaceta as they are processed by the ministry.

Here are the tracts and bidders as they have appeared in the government publication:

. . . Block 17, Lake Maracaibo, went to a seven-company combine headed by Phillips Petroleum Co. Others in the group are Kerr-McGee Oil Industries, Inc., El Paso Natural Gas Co., Western Natural Gas Co., Ashland Oil & Refining Co., Sunray Mid-Continent Oil Co., and Canadian Atlantic Oil Co., Ltd.

This same group was awarded a tract of 40,000 hectares in Venezuela's little-known State of Tachira along the Colombian border in the extreme southwest corner of the country. The government has made it a policy to compel successful bidders for the more promising areas also to take on exploration concessions in the outlying districts.

. . . Block 15, Gulf of Paria, went to Cie. Shell de Venezuela.

. . . Blocks 22, 23, 24 and 28, Barinas, went to Creole Petroleum Corp. This is a total of 80,000 hectares.

. . . Block 5, Northern Monagas, a tract of 29,500 hectares, went to Creole.

. . . Blocks 10, 31, and 32, Southern Monagas, a total of 31,000 hectares, went to Creole.

. . . Block 26, Barinas, a tract of 20,000 hectares, went to Kingmill Oil Co., a new company.

. . . Block 12, Lake Maracaibo, a tract of 10,000 hectares, went to a four-company group composed of Venezuelan Sun Oil Co., Pan American Petroleum Corp., Atlantic Refining Co., and Seaboard Oil Co.

This group also took a 10,000-hectare exploration tract in the State of Apure in the extreme southern portion of Venezuela.

Russian oil men conclude:

Turbodrill No Cure-All

SOVIET oil men are trying to put their turbodrill in proper perspective.

They've found that the highly touted tool is not an answer to all drilling problems. On the other hand, they are justifiably proud of what it has done.

The U.S.S.R.'s Ministry of the Petroleum Industry says that the most efficient way to use turbodrilling is by combining it with rotary drilling. The formula: Use the turbodrill to penetrate hard rock and softer rock with hard interstratification, and the rotary for uniformly soft rock and clayey formations.

The Russians have learned that "combined" or "split" drilling:

. . . Increases over-all drilling speeds by increasing penetration rates.

. . . Requires fewer bits.

. . . Decreases use of chemicals and weighting material because of reduced drilling time.

The key to the success of "combined" drilling is the higher penetration rates from rotary drilling in soft formations. The absence of the turbine in rotary drilling allows higher circulation rate; improves bit cleaning; and results in faster drilling.

What the Russians did . . . Last year, Soviet oil men demonstrated the turbodrill to American observers in Bashkiria. Working in hard formation, the turbodrill penetrated at a fantastic rate of 100 ft. per hour—against 2 ft. per hour for the rotary.

Now, Russia's oil ministry says that the turbodrill cannot always be expected to outperform the rotary. This is based on experience by the Black Sea Oil Trust in the Krasnodar area of the Black Sea's northeast coast.

There, the turbine method brought poor results in four tests. Average penetration rate was only 16.4 to 23 ft. per hour. The geological profile is divided into three formations in that area.

From surface to 4,260 ft., the formation is clay with occasional lenses of conglomerate 6 to 10 ft. thick; coarse sands with beds of viscous clay; beds of loosely cemented sandstone; and sand 100 to 130 ft. thick with zones of viscous clay.

From 4,260 to 6,500 ft., the formation is clay, frequently alternating with hard rock—sandstone, dolomite, and marl.

The third formation (Maikop) is chiefly folded clay from 6,500 to 8,370 ft.

"Especially low mechanical speeds (7.5 ft. per hour) were obtained in the Maikop," wrote I. I. Trufanov, senior engineer in the production technical section of the Trust, in an article for the official magazine Neftyanik (Oil Worker).

So they decided to try rotary drilling to 4,205 ft., turbine at 4,205-7,340 ft., and rotary again from 7,340-8,370 ft.

Here are the best results from four "combined" operations:

. . . Footage per day leaped to 361-372 ft. at well No. 241.

. . . Penetration rate soared to 56.4 ft. per hour.

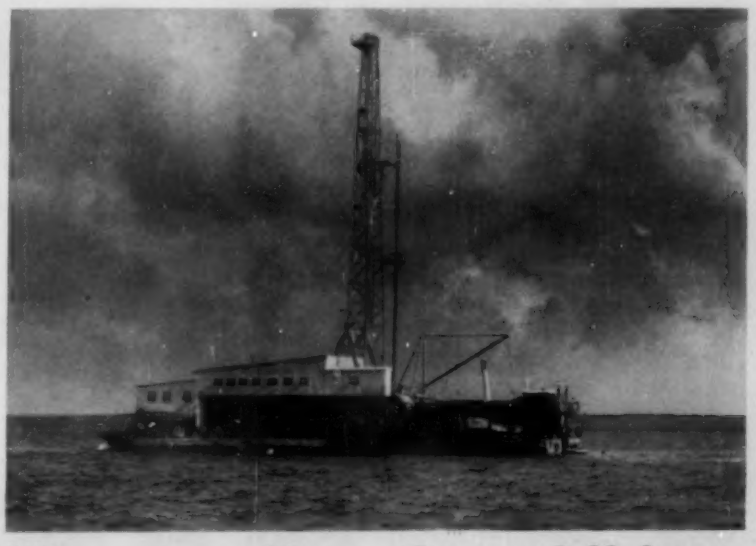
. . . Completion time was 24 days, compared with a norm of 45 days.

. . . A total of 19 bits were saved on another test—the 203.

. . . A much faster penetration resulted in the second Maikop horizon found at 7,340-8,370 ft.

At the 203, the rotary drilled the Maikop 3.6 times faster than turbodrills had penetrated the same formation at other wells. Only three bits were used compared with 10 bits in turbodrilling.

As a result of these successes, the Russian ministry advises close study of an area's geological profile before deciding whether to use the rotary, turbine, or combining the two.



Nicaragua Hunt Goes Offshore

THIS lonely barge rig, sitting nearly 25 miles out in the Caribbean Sea, is drilling the first oil test off the coast of Nicaragua.

The deep wildcat is a joint operation of J. Ray McDermott & Co., Inc., Houston; Waterford Oil Co., New Orleans; and Warren Petroleum Corp., Tulsa, a subsidiary of Gulf Oil Corp.

Projected to 13,500 ft., the well last week was reported to be below 7,500 ft. It is offshore from Puerto Cabezas.

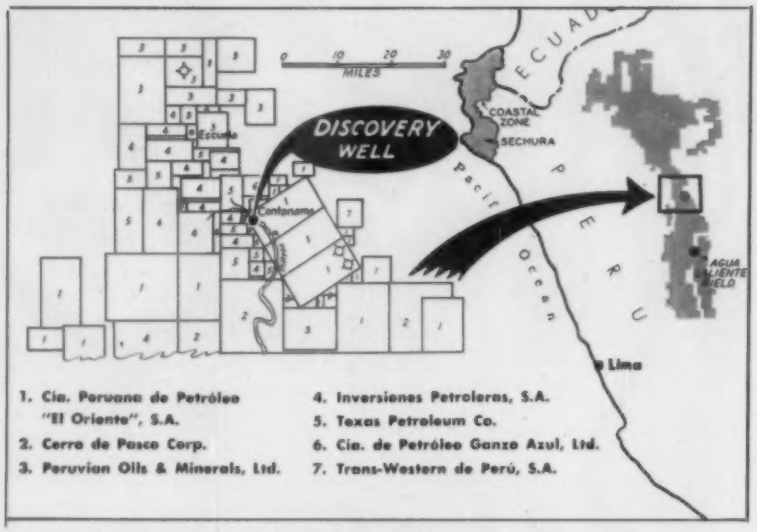
The test is on an 11,000,000-acre oil and gas concession held by the three companies from the Nicaraguan Government. The concession extends along the Caribbean Coast of Nicaragua and covers a wide area both onshore and offshore.

Gulf Oil Corp. and Atlantic Refining Co. formerly owned the concession. They drilled two shallow dry holes onshore.

J. Ray McDermott & Co., operator for the three companies, is a well-known New Orleans construction firm prominent in offshore oil work. Its oil division, with headquarters in Houston, has production in several states.

Waterford represents a group of eastern financiers.

Although the well is located far at sea, it is in water only about 6 ft. deep. It is being drilled by Caribbean Drilling Co., a Panamanian corporation. The drilling unit was leased from Harvey Drilling Co., Inc., Harvey, La. The well was spudded in February shortly after the barge rig was towed to location from New Orleans.



CONCESSIONS on 36,000,000 acres east of the Andes (right) arouse interest after . . .

Peru Strike Looks Good

● El Oriente's shallow discovery opens new pay in remote Amazon basin with a daily flow of 605 bbl.

SOME oil men believe the new discovery in eastern Peru is the long-awaited success that will crack open the country's Amazon basin.

Maquia 1, 3 miles east of the Ucayali River near Contanama, is the first Peruvian discovery east of the Andes since 1938. Ganso Azul, or Blue Goose field, was found on the Agua Caliente concession at that time.

The new discovery was drilled by Cia. Peruana de Petroleo "El Oriente," S.A. This is a local Peruvian company. Three German firms have a 50 per cent operating interest.

Here are the details that made the test look promising to geologists:

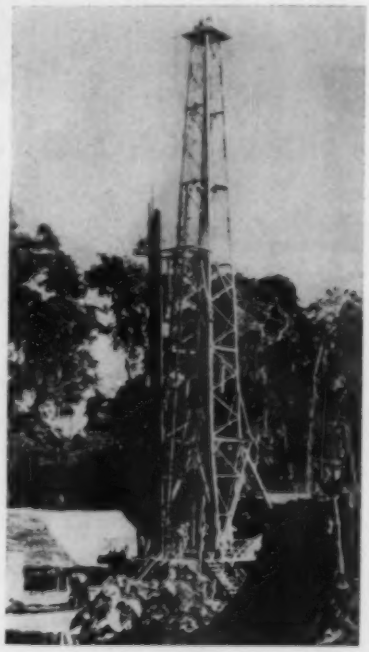
. . . The well flowed 605 bbl. on an actual 24-hour test through a 15/64-in. choke. Flowing pressure was 260 psi. Early reports were that the gravity was 30° plus.

. . . Production is shallow. Output comes from 2.150 ft. Total depth of the hole is 5,322 ft. The well encountered sands productive at Agua Caliente, but these were dry.

. . . The producing formation is known locally as Sugar sandstone. The test was made on a 25-ft. section. Total thickness of the horizon was not immediately determined. This sandstone outcrops further up the river in the vicinity of Agua Caliente, about 100 miles to the south.

The discovery was El Oriente's third on three continuous concession blocks totaling 176,000 acres. The Cashiboya and Inuya tests encountered the Sugar sandstone at shallower depths. But both were dry holes. El Oriente also has acreage on several smaller blocks in the immediate vicinity (see map).

The company is controlled by a local Peruvian family, the Guildermeisters. The three West German independents are Gewerkschaft Elwerath, Hanover; Wintershall A. G., Kassel; and Deutsche Erdoel A. G., Hamburg.



THIS GERMAN-BUILT RIG of Salzgibber design made the Maquia discovery.

Area split up . . . The diversified ownership of concessions in the vicinity indicates the area has been considered a good bet. Blocks over most of Peru's Montana normally run more than 100,000 acres. But more than 20 near Contanama are between 1,600 and 7,400 acres. There are a few 124-acre tidbits.

Three companies have acreage within 5 miles of the discovery. They are Texas Petroleum Co., Inversiones Petroleras, S. A., and Cia. de Petroleo Ganso Azul, Ltd.

Three others have acreage within 15 miles, Cerro de Pasco Corp., Peruvian Oils & Minerals, Ltd., and Trans-Western de Peru, S.A.

Andes a barrier . . . Eastern Peru has drawn increasing interest for two reasons. The region was opened under favorable terms of the 1952 oil law, and exploration in the coastal Sechura Desert has met with poor results. At last count, 17 companies had 36,000,000 acres under concession east of the Andes Mountains.

The big drawback to the Amazon region is its remoteness. Major production would be needed to make a pipeline across the Andes pay.

But even small-scale commercial production at Contanama would likely have a market. Crude currently is barged past the town on its trip down the Ucayali, a tributary of the Amazon. It originates in Agua Caliente field, and is shipped by a 56-mile pipeline to Pucallpa. Barges then take the crude 600 miles to Iquitos refinery, or 1,800 miles to Manaus refinery in Brazil.

Ganso Azul is owned 80 per cent by Texas Gulf Producing Co., and 10 per cent each by Bay Refining Co. and Kendall Refining Co.

Two Deals Made in Panama

Cataract Mining Corp., which holds more than 2,000,000 acres of concessions on both sides of the Canal Zone, has made two exploration agreements in Panama.

The New York firm granted Columbus Rexall Oil Co., Long Beach, an undivided half-interest in 850,000 acres in the Province of Darien and signed an agreement to explore a 52,000-acre concession held by Cia. Petrolifera de Chercha in Chiriqui Province.

Convoys Sailing Suez

Light vessels resume traffic for first time in 5 months as Nasser and West continue to haggle over toll split

CONVOYS of light vessels last week picked their way through the Suez Canal for the first time in 5 months.

This partial resumption of traffic through the waterway focused attention on the canal's shaky future. The outlook was emphasized by two other events:

... **Egypt's President Nasser** reportedly was looking for a loan to put the canal back in first-rate operating order.

... **A forecast on future traffic** and needed improvements to the canal was released by the old Suez Canal Co.

... **Disagreement still existed** between Nasser and western nations, notably the United States, on management of tolls collected from shippers.

Amount of the loan sought by Nasser was reported at $10 million. Banking circles said it was being requested to cover the immediate expenses of running the canal.

The outlook ... The former company which operated the canal before it was seized by Egypt paints a bright future for the waterway.

Its report said if confidence of users is restored, this should be the situation by 1972:

... **Oil traffic** will increase nearly five times, reaching 335 million tons a year compared with 69 million tons in 1955.

... **The average size** of loaded tankers will be 32,100 deadweight tons compared with 18,900 tons in 1955.

... **Average number of ships** using the canal daily will rise from 40 in 1955 to 86. And 61 will be tankers.

... **The canal will have to handle ships** drawing up to 39 ft. in contrast to the 35-ft. top draft early in 1956.

Turns other cheek ... The company estimated a $287,000,000 improvement program would meet needs through 1972.

Financing the work, whether the recommended program is followed or not, is one of the main problems facing President Nasser. He proposed setting aside 25 per cent of the tolls for development and 5 per cent for payment to former shareholders.

The United States and other Western countries have proposed setting aside 50 per cent for developing the canal and for a fund to be held for company shareholders. The company's concession was cut off 12 years early in July 1956.

In the 3 years before nationalization, the company itself spent 23.4 per cent of its receipts for improvements.

The company made no comment on the nationalization or on the future operators. It announced it would turn over engineering and other work "to any organization which will take over the traditions to which throughout the last 100 years, the Universal Suez Canal Co. has remained faithful."

The company's program of improvement would have made the canal two-way for two-thirds of its length. Vessels of 38-ft. draft would clear by 1965 and of 40-ft. draft by 1968. The railroad swing bridge over the canal would be replaced by a tunnel.

Qum Deal Denied

Iran says Italian firm only seeking to buy oil

NATIONAL IRANIAN OIL CO. finally broke its 2-week silence to slap down reports that the Italians were being handed the development of Iran's Qum oil find.

The government-owned Iranian company describes as "baseless" the widely published reports that Enrico Mattei, politically potent head of Italy's Ente Nazionale Idrocarburi, has made a deal in Iran.

An N.I.O.C. spokesman in Teheran last week said the Iranian company has been talking to the Italians about sale of Iranian crude, nothing more.

A week ago Europe was being flooded with press reports originating in Rome that E.N.I. was going to develop the spectacular Qum oil find. None of the news articles attributed the stories to anyone official, but each had the appearance of authenticity.

According to the reports, which N.I.O.C. now labels fictitious, E.N.I. and the Iranian government agency would form a joint company which in turn would pay royalties to Iran. This would in effect make the profit split 70-30 in favor of Iran.

Even though the reports were persistently and widely distributed in both Europe and the U. S., they were met with open skepticism in this country *(The Oil and Gas Journal, Newsletter, April 1).*

——— *World* briefs

Shell-BP Development Co. of Nigeria has abandoned Oloibiri 4 as a dry hole at 10,500 ft. The test apparently established the southern limit of the 3-well field. Oloibiri 5 will be drilled about 2 miles southeast of No. 3. Production tests are due to begin at midyear. The field will be tested one well at a time, producing an expected 1,000 bbl. daily.

A new Australian-backed company, Timor Oil, Ltd., has been set up to carry on exploration in the Portuguese half of Timor Island, north of Australia. The project is one of the first backed by Australian money to venture beyond the country's territory.

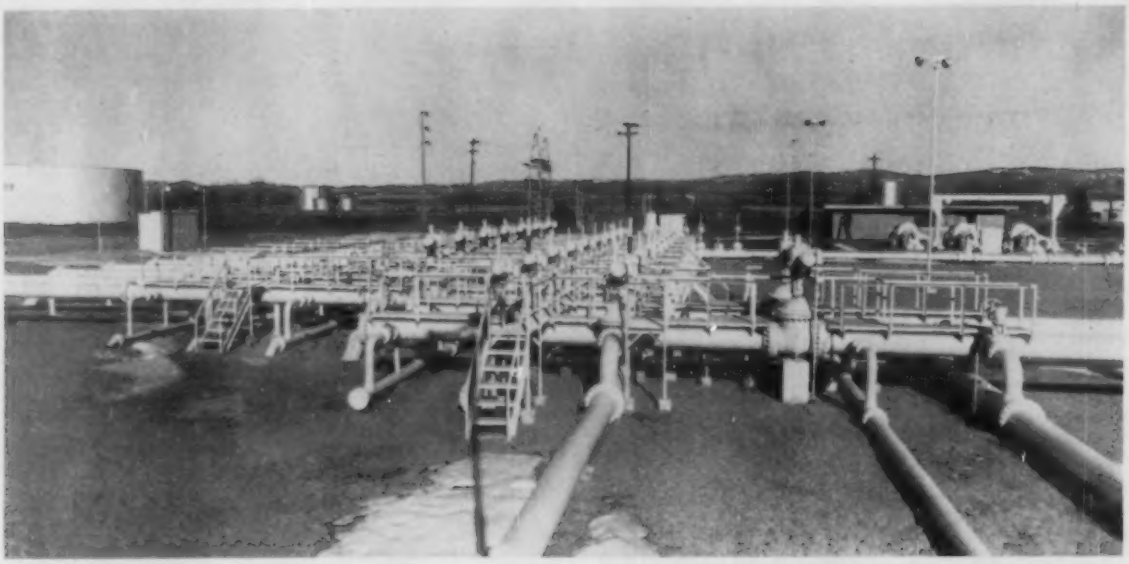
Syria may have given the green light on its long-discussed refinery. Reports from Damascus are the government has approved the construction contract for 20,000-bbl. plant to be built by Technoexport, of Czechoslovakia. Bids on the project were made a year ago by firms in several countries.

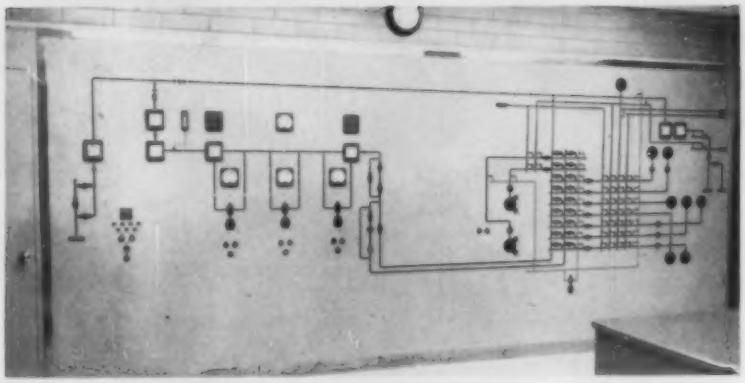
Richmond Petroleum Co. (Standard Oil Co. of California) has been granted a concession of 30,180 acres in the Department of Bolivar in North Central Colombia. The tract is near Mompos, Margarita, and San Fernando.

Shell Co. of Thailand, Ltd., and the Thailand Government have reached a new agreement on land rentals. The marketing company will reduce some of its holdings and will pay more rent on the rest. In return, the company received a 15-year guaranteed tenure after which a 12-year notice of cancellation is required. Standard-Vacuum Oil Co. has signed a similar agreement.

France plans to add more than 1,- 000,000 tons to its tanker fleet within the next 5 years—most of it in big tankers. The French plan to have a tanker fleet of 2,300,000 tons by 1962. This compares with the present fleet of 1,275,000 tons. French operators now have on order 22 tankers averaging 51,000 tons each, compared with the average of 31,000 tons per tanker delivered in French yards last year.

A 4,100-bbl. daily Sovaformer and a 5,500-bbl. cat-hydrogenation unit have been completed at Mobil Oil A.G.'s refinery at Bremen, West Germany. The company is increasing capacity of the plant from 17,400 bbl. to 25,000 bbl. daily.





MANIFOLD AREA, above, showing motor-operated valves, and piping in foreground; supervisory control and control center to the left; substation, switchgear, and station booster pump in rear center; main pump units, control and office building to the right. The picture at left shows front view of main control panel, with flow diagram and equipment controlled and supervised from the panel.

by P. P. Plovanich and E. E. Hogwood

AUTOMATIC WATCHMAN

"Supervisory Control" Goes Local

The idea of using this system over short distances for local station control has several advantages

SUPERVISORY control is used in a new and unusual manner to improve efficiency of the modern, locally controlled Fort Laramie station of Service Pipe Line Co.

This is the first application of supervisory control over short distances for local, rather than remote, station control. It has several advantages. Among them are:

P. P. Plovanich is electrical supervisor, Service Pipe Line Co., Tulsa, and E. E. Hogwood is with the industry engineering department, Westinghouse Electric Corp., East Pittsburgh, Pa.

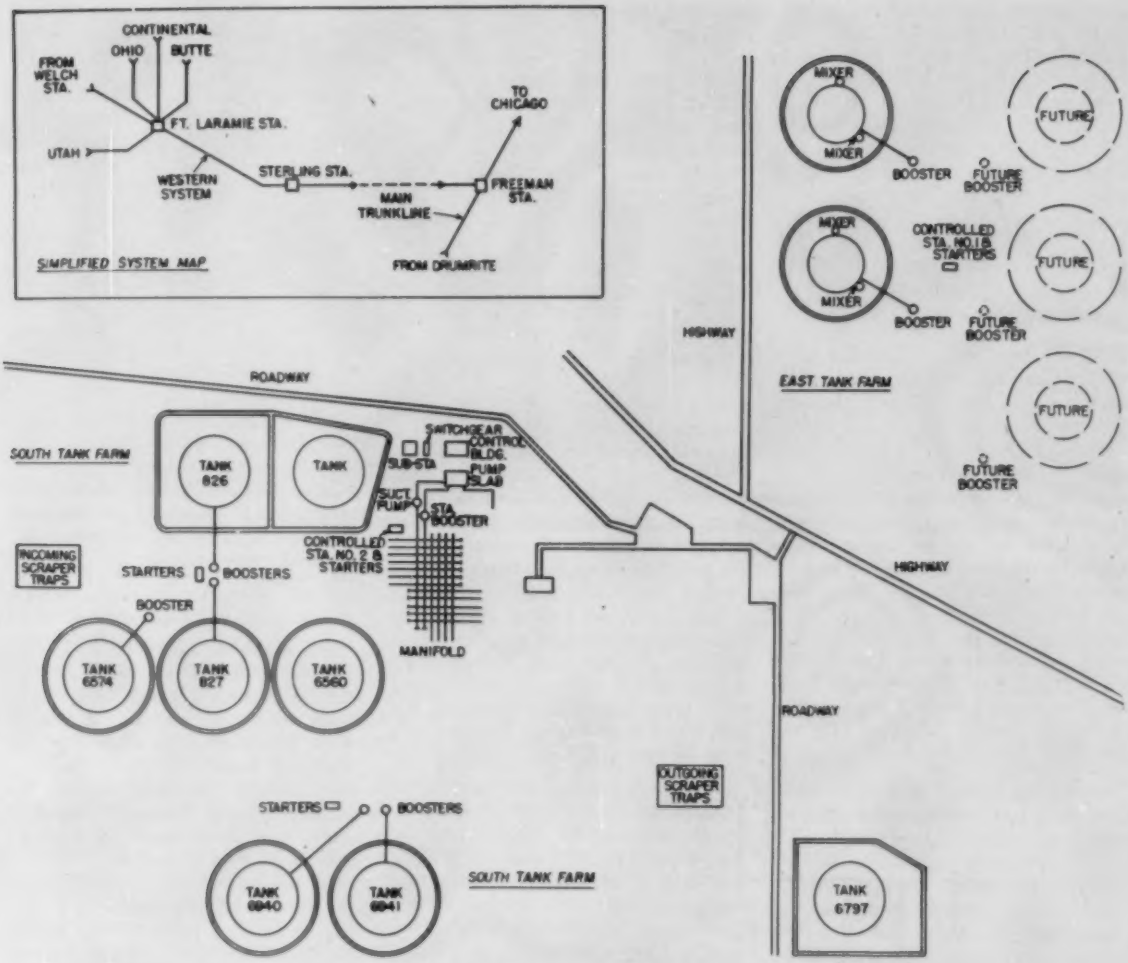
- Fewer operating personnel required since supervisory and station control simplifies operating procedures.
- Lower operating costs.
- Reasonably short equipment payout.
- Ease of expansion.

Supervisory control was chosen for certain functions after a careful economic study of other methods of accomplishing the same functions. This article will describe the electrical features of the Fort Laramie station and in particular will discuss this application of supervisory control.

PIPELINING

Station Features

The station is located in the old frontier town of Fort Laramie, Wyo., on the 20-22-24-in. main line of Service Pipe Line Co.'s western system. This originating station of the 20-in. line is a conversion and expansion of an engine-driven station



PLAN VIEW of the Fort Laramie station and associated tankage (piping omitted). Fig. 1.

that has existed here for several years.

The station was built in 1936. Before installation of the diesel engines in 1946, the station had two electric motors operating on power from Guernsey Dam. Increased crude production in Wyoming called for larger motors but additional electricity could not be obtained and Service switched to diesels in 1946.

The diesels were 25-year-old engines from other locations on the system with a total capacity of approximately 1,500 hp. To meet pumping requirements, it was necessary to install portable outdoor units.

When the new western 20-22-24-in. line was built, it became apparent that new machinery was required. With an attractive electric rate in this area, the electric drive indicated a more rapid payout than other types of drives. The decision was then made to go electric.

Crude oil is received from Ohio Oil, Continental, Utah, and Butte pipelines as well as from the upstream Welch station. The crude oil is received in 10 tanks totaling 665,000 bbl. It is batched downstream to Sterling station where it is relayed on to the Kansas City junction at Freeman station on the main trunk line from Drumright, Okla., to Chicago. Fort Laramie station consists of two 1,000-hp. and one 800-hp., 3,600-r.p.m. main pump units with provisions for one additional pump unit in the future. Present throughput with three-unit operation is 130,00 bbl. per day.

The layout of the station is shown in Fig. 1. All the main equipment is located outdoors, eliminating the need for costly buildings to house pumps, motors, and switchgear. A control and office building is provided to centralize the operation of the station from a 20-ft. diagrammatic panel which contains a flow diagram of the main station piping and tankage. The building is 20 by 50 ft. and is constructed of masonry with glazed-tile interior and buff-brick exterior. It consists of a control office, shop, small laboratory, storage room, and locker room.

Main pumps and motors . . . The three main-line pump units are located approximately 50 ft. in front of the control building on a machinery slab. The pumps are two-stage centrifugals driven by Westinghouse outdoor, weather-protected, 2,300-volt, 3,600-r.p.m. squirrel-cage, induction motors. These motors are specially constructed open motors equipped with air baffles and removable filters to prevent rain, snow, dust, and other foreign objects from entering the motor windings.

The use of weather-protected motors enabled Service Pipe Line to obtain a very economical installation from the standpoint of first cost, since a pump building and explosionproof or forced-ventilated motors were not required. A minimum of building construction was necessary to house the

control panel, tank-gaging equipment, indoor control center, and communication facilities.

Switchgear . . . A simplified single-line diagram of the electrical system is shown. Station power at 2,400 volts is supplied to the outdoor metal-clad switchgear by two parallel underground cables from the power-company substation. The metal-clad switchgear is of the horizontal-drawout, air-break design which is the ultimate for pump-station protection due to its reliability, ease of maintenance, and safety features. Standard outdoor, factory-assembled, metal-clad enclosures eliminate the need for a switchgear room or building.

The incoming line and four feeder circuit breakers are each rated 1,200-amp., 50,000-kva. interrupting capacity, which allows the use of one spare breaker for the station and insures a minimum of down time during switchgear maintenance. Three of the 2,400-volt feeders are connected to the main pump motors, and the fourth feeds tank-farm booster-pump starters near the four outdoor booster-pump locations. Sequence control is provided for the motor-feeder breakers and the unit suction and discharge valves as described more fully under station controls.

Booster pumps and starters . . . Eight 125-hp., 2,300-volt motors drive the tank and station suction booster pumps. The 2,400-volt fused starters for these motors are assembled in four groups and are located outdoors near the associated booster pumps. The station booster-pump starter is on the same slab with the outdoor control center and supervisory-controlled station No. 2 near the manifold. A single three-phase, 2,400-volt cable feeds power to this starter from the switchgear.

Two additional 2,400-volt cable feeders are supplied from the station booster-pump starter, one to three tank boosters in the west tank farm and, one to two boosters in the south tank farm. A separate single three-phase cable is fed from the switchgear to the east tank-farm starters for the two booster pumps located there.

The 2,400-volt control in the east tank farm is arranged for the future addition of three tank booster-pump starters which will serve three future tanks there. Supervisory-controlled station No. 1 is located on the same slab with the east tank farm 2,400-volt control and will be described more fully later as will the remote operation of all the high-voltage control.

Auxiliaries . . . All the station auxiliaries are fed from the 480-volt secondary of a 112½-kva. three-phase transformer through an indoor and outdoor control center. Primary power at 2,400 volts is fed to the transformer through a fused load-breaker disconnect switch mounted in the metal-clad switchgear. The outdoor control center consists almost entirely of 480-volt starters which supply power to a large number of motor-operated manifold valves. The indoor control center supplies 480-volt power to the air compressors, all the unit suction and discharge valves, motor heaters, lighting, and station heaters.

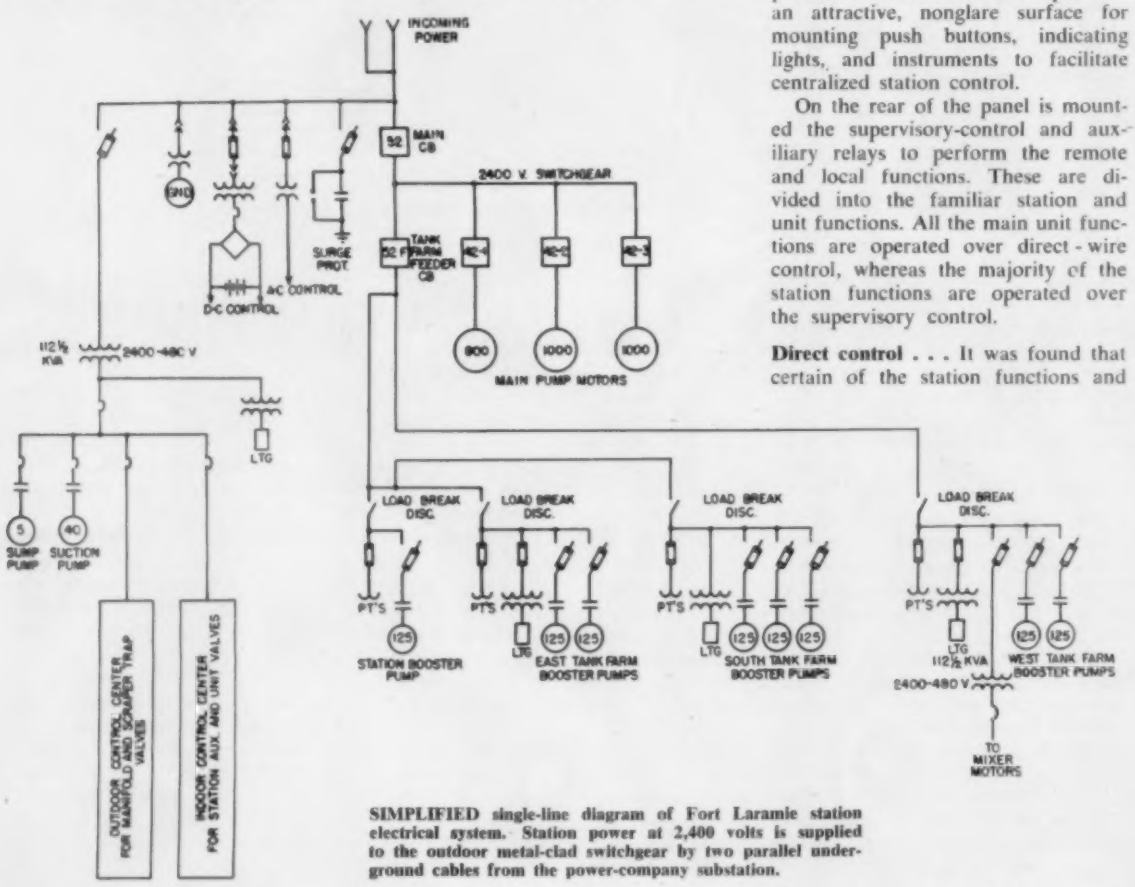
A second 112½-kva., three-phase transformer is located in the east tank farm and supplies 480-volt power for the tank-mixer motors on the two tanks there.

Station Controls

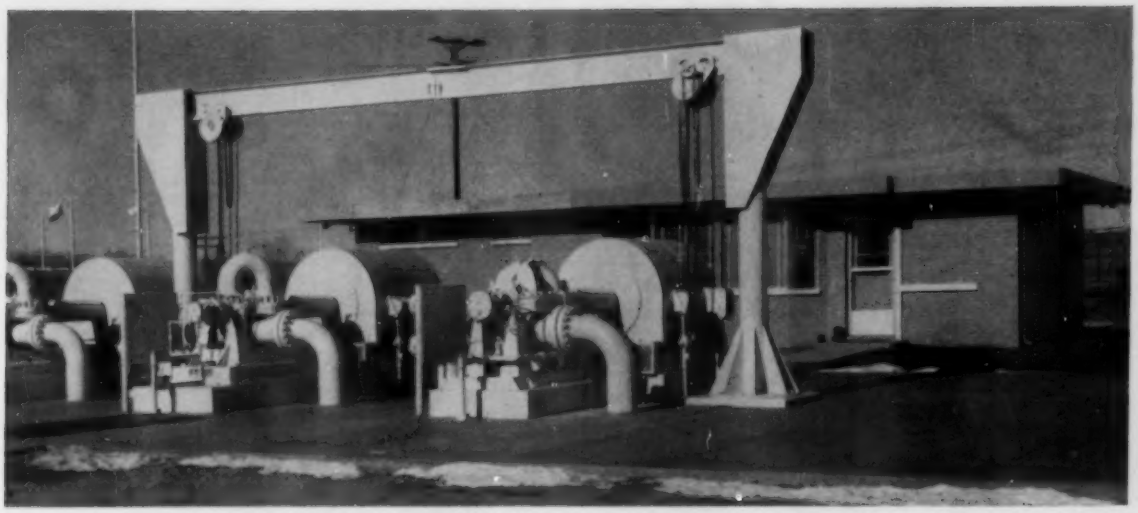
The entire station control, including that of the manifold, is centralized on a vertical panel 20 ft. long, which forms one wall of the control room. The diagram panel is of a new processed aluminum which provides an attractive, nonglare surface for mounting push buttons, indicating lights, and instruments to facilitate centralized station control.

On the rear of the panel is mounted the supervisory-control and auxiliary relays to perform the remote and local functions. These are divided into the familiar station and unit functions. All the main unit functions are operated over direct-wire control, whereas the majority of the station functions are operated over the supervisory control.

Direct control . . . It was found that certain of the station functions and



SIMPLIFIED single-line diagram of Fort Laramie station electrical system. Station power at 2,400 volts is supplied to the outdoor metal-clad switchgear by two parallel underground cables from the power-company substation.



HERE ARE two 1,000-hp. and one 800-hp., 3,600-r.p.m. outdoor weather-protected main pump units.

all of the unit functions could be handled more economically by direct-wire control than by supervisory control. The reasons were the proximity of the equipment to the control room and the relatively few functions to be performed.

For instance, the main pump units are sequence controlled over direct wire due to the interconnecting circuitry required between the associated unit valves, the indoor control center, and the outdoor switchgear. The station operator may operate an automatic-manual selector switch to arrange any one of the main pump units for sequenced or manual control. Under manual control the unit suction valve, circuit breaker, and discharge valve are all operated by push buttons or switches at each device. In either case, the unit's valve positions, protective functions, circuit-breaker position, and direction of flow are supervised by direct wire to indicating lamps appropriately placed on the flow diagram.

The only station function operated by direct wire from the main panel is the station main breaker in the outdoor switchgear. This breaker may be closed from the panel after a power outage or any other fault that has been cleared, and it may be tripped by the "emergency stop" push button also located on the panel.

A few other station functions such as operation of the tank-farm feeder breaker and the station protective devices are handled by direct wire; however, most of them are handled by the supervisory control, which makes this station unique.

Supervisory Control

The supervisory control consists of one controlling station incorporated into the main diagram panel and two controlled stations located (1) in the east tank farm, and (2) at the manifold. This equipment is of the Visicode supervisory-control design which employs a "checkback" on the code sent and device selected prior to operation of that device.

Service Pipe Line is the first pipeline company to use supervisory for local station control and supervision of a large number of motor-operated manifold valves over a relatively short distance. The manifold is 200 ft. from the control room and presently contains 18 motor-operated valves, 48 manually operated valves, and 9 other valves which are to be motorized later.

Near the manifold is controlled station No. 2 of the supervisory by which each of the motor-operated manifold valves may be independently operated from the main control panel. The only control wires required between this controlled station and the main panel is one pair of metallic conductors. Of course, individual control wires and power cables are required from controlled station No. 2 and the control center to the various manifold valves. The expense of these short cable runs is small compared to the investment required if conductors had been run from the control room to each valve.

Valve operation . . . The position of each of the motor-operated and several of the manually operated manifold valves is supervised on the diagram panel by means of blue and amber indicating lamps in the valve symbol. To operate one valve, or a number of valves in succession, the operator merely turns the associated push button to "open" or "close" and depresses it.

The supervisory sends a code to select the desired valve, then the controlled station sends back a "check" code, and if the two codes agree, the controlling station sends an "operate" code automatically to move the selected valve to the desired position. As the valve changes position, the lamps on the diagram panel change from blue, to blue and amber, to amber or vice versa due to action of the valve limit switches operating into the supervisory control.

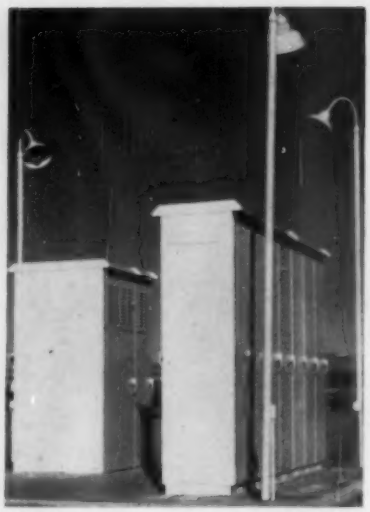
When the valve leaves the extreme position, the supervisory is reset. The valve continues to the extreme position where it is stopped by a limit switch. As the supervisory is reset, the next chosen valve will be selected, checked, and operated. This allows the operator to select a path for the oil through the manifold and lets the supervisory operate to set up that path with a minimum of effort. Complete information on the operation of the manifold and associated equipment is always displayed before the operator on the panel.

If, for any reason, the motor-operated valves are moved locally from the position last initiated by the supervisory control, the lamps on the panel will change from, say, amber to flashing amber and blue, and the alarm bell will sound. The flashing lamps immediately isolate which valve has changed position.

If the valve continues to close, the lamps will then change from flashing amber and blue to flashing blue as the valve completes its closure. The operator may silence the alarm by pressing the alarm silence button and make the lamps burn steady by pressing the reset button.

The operation of the starters for the south and west tank farm booster

OUTDOOR 2,400-volt metal-clad switchgear and power-company substation.



CUBICLES housing supervisory controlled station No. 2, outdoor motor control center for manifold valve motors, and incoming line sections and starter for the 125-hp. station booster pump motor.

pumps, and the station booster pump and isolation valves is also incorporated into controlled station No. 2. These functions were combined with those of the manifold as a matter of economy and because the six booster pumps were located reasonably close to the manifold.

The additional cost of a third controlled station in the south tank farm just for the operation of three booster pumps could not be justified because the pumps are only 300-500 ft. away from controlled station No. 2. Also the 2,400-volt starters for these and the south tank farm booster pumps are centralized in the tank farms.

Controlled station No. 1 in the east tank farm is 2,000 ft. from the control building. The operator is provided control and supervision of two tank booster-pump motors and four tank-mixer motors on the main control panel. Operation of a booster-pump or tank-mixer motor is similar to that of a valve described above in that the pump is selected, checked, and then started. Space is provided on the panel for the future addition of three tanks and the associated booster pumps and tank-mixer motors. Likewise, provisions were made for the required additonal control and supervision points in the supervisory.

Tank-flow supervision . . . An interesting feature connected with all the working tanks is that the direction of flow into or out of the tank is supervised to the main panel and displayed by means of two amber arrows in the fill line of each tank. The correct flow arrow is illuminated by certain relays or combinations of relays in the controlling station supervisory control. Each valve in the manifold is assigned a supervisory point number and the **C** relay associated with this point remains energized when the associated valve is open.

The selection of the proper points or valves for illumination of a particular flow arrow was determined on the basis of the station operating procedure. It was known that when particular valves or combinations of valves were open the flow would be into or out of the tank. Use of the flow arrows simplifies the station operator's job and keeps him informed.

Advantages

Supervisory control was chosen for the functions outlined above after a careful economic comparison with direct-wire control. The first cost of the supervisory was higher than that of the direct-wire system alone. However, when an over-all comparison was made, including the installation cost of each system, the supervisory control was favorably lower. The decision to use supervisory was made on the basis of this comparison and with the thought that it would have the additional advantage of future expansion at a reduced cost plus flexibility in operation.

No additional conduits or conductors are required between the controlling and controlled stations of the supervisory regardless of the number of additional functions later required. In contrast, the direct-wire system necessitates that space conduits and conductors be installed initially or added later at greater expense when additional functions are required. It is anticipated that at least three additional tanks, associated tank booster pumps, tank mixers, and several manifold valves will be required in the future; therefore, the ease-of-expansion feature was important although difficult to evaluate in actual dollars.

By the use of the supervisory control, the complete diagram panel, and instrumentation of the pertinent quantities centralized in the control room, the station can be operated at lower cost. This advantage allows the equipment purchased to be paid out in a reasonably short time and reduces the operating costs in general for the remainder of the station's life.

Conclusions

Remote control of pipeline stations has gained increased popularity during the past several years, and it is expected that its greater use as a means of reducing operating cost will be seen in the next decade. The idea of using supervisory control over short distances for local, rather than remote, station control is new and has several advantages over direct-wire control when a large number of control and supervision points are involved.

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"Give us something on acid handling . . ."

. . . that's what refiners told us when we asked them what we should write about on alkylation. Other problems come and go, but corrosion and safety factors in acid handling are always around. So, here are some typical problems and their solutions.

by Larry Resen
District Editor

Problem: Acid-Pump Corrosion

Solution: Revamp of acid-proportioning pump.

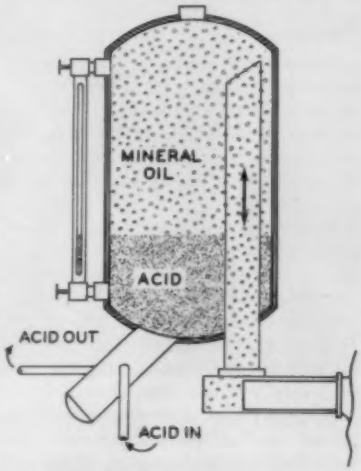
Discussion: An acid-proportioning pump was designed to use mercury as a seal between the acid and the working parts of the pump. In operation, the mercury and acid emulsified so that the mercury carried out with the acid leaving the working parts of the pump exposed to acid attack. A secondary problem developed since the mercury carried into lead-caulked acid drains causing them to leak.

The best way to alleviate this condition was to eliminate any contact between mercury and the acid. To this end, the pump was revamped and mercury removed from the system entirely. Highly treated mineral oil of pharmaceutical specifications is now used in direct contact with the acid and seals it off from the pump.

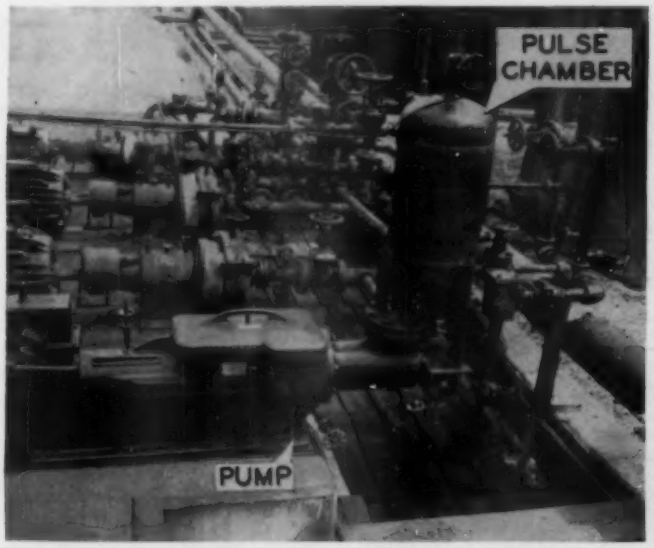
With this arrangement, no contamination of the acid can occur. Going a step further, the same oil is used as a pump lubricant. Hence, any leakage into the mineral-oil seal will be of the same material and hence will not cause contamination.

How it works . . . The acid-proportioning pump is an adjustable-feed, pulse type of pump, which employs the mineral oil as the pulse medium to transmit the pumping action to the acid, thereby preventing the acid from contacting the pump itself. The pump proper consists of a pump cylinder mounted on a piston crosshead type of frame with the pump plunger connected to the crosshead through a push rod.

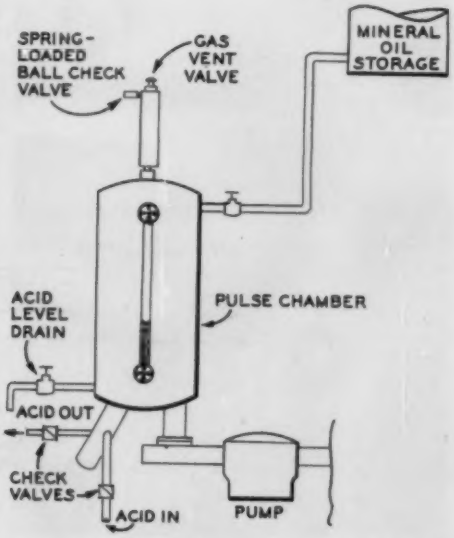
The push rod passes through a yoke which is filled with enough oil to cover the gland and exposed end of the plunger. The crosshead is stroked back and forth by an adjustable crank and a connecting rod. The crank is



MINERAL OIL rides on the acid surface in the pulse chamber.



ACID-PUMPING SYSTEM uses mineral oil as the pulse medium to transmit pumping action to the acid.



THE PULSE CHAMBER is the heart of the acid pumping system.

Blitzing Alkylation Problems

attached to the speed-reducer output shaft with a shear pin for pump protection. The pumping action created by stroking of the plunger is transmitted directly to a reservoir of oil which in turn transmits the pumping action to the acid.

The oil reservoir, or pulse chamber, is designed to reduce the possibility of acid's getting into the pump proper. As can be seen from the sketch, as long as the acid level is kept below the center of the gage glass, the acid will not carry over into the pump.

Check valves in opposition to each other are located on acid lines connecting to the lower extension of the pulse chamber. As the pump applies suction to the system, the acid input line check is opened and the output line check is closed. Acid enters the pulse chamber on this stroke. As the pump plunger reverses direction, the check valves reverse position and acid is ejected through the outgoing line.

The pulse chamber is equipped with a gas vent valve and check valve as well as an overhead filling line. Mineral oil is stored in an elevated drum and added to the system by gravity flow as required.

Problem: Handling Sulfuric Acid

Solution: Use 316 stainless steel.

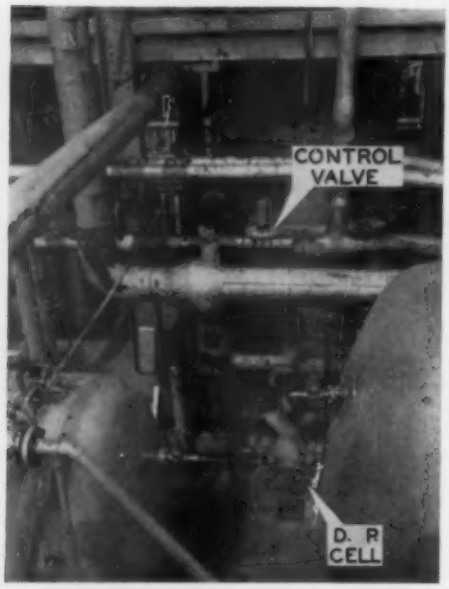
Discussion: Sulfuric acid can be measured by tank gage, pump stroke, or some other less-convenient or less-accurate method. In an effort to improve a unit's operation, mercury instruments were installed, but these were unsuccessful. Mercury in contact with the acid would tend to emulsify and mineral oil had to be used as a seal between the two. Otherwise, emulsification would occur and plugging would take place in the system. A great deal of upkeep was required to maintain such seals, and the performance was less than desired.

The mercury instruments were replaced by differential-pressure cell flow transmitters installed across the orifice flanges on sulfuric acid flow lines. The acid made direct contact with the cell diaphragm and changes in flow could be positively measured in this manner. Pneumatic receiver controllers are then used to actuate the control valves on the flow line in response to the flow-rate signals. In the initial installation of the cells the bodies were made from 316 stainless steel and the diaphragms fabricated from acid-resistant bronze. This latter material failed in service and a switch was made to 316 stainless for the diaphragm. This combination has proved successful.

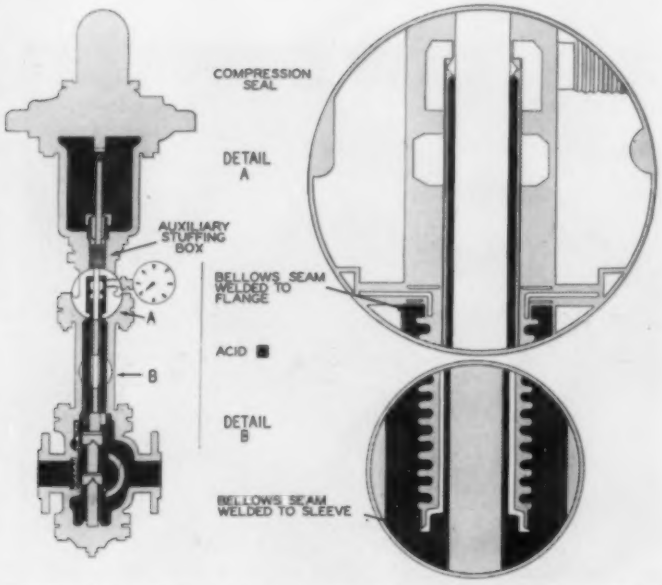
CLOSEUP of D. P. cell and transmitter.

The cell can be close coupled to the orifice eliminating long runs or the need for any seal at all between the diaphragm and acid, insuring positive action. The only maintenance required has been a semiannual cleaning as a preventive measure and a weekly flush. Bypass lines are set up to permit this flushing. This latter measure is quite significant. With alkylate present in acid streams, polymerization can occur where there is no circulation. Hence, this flushing cleans out any pockets which occur, thereby preventing polymers from forming. To this end, piping is designed to avoid U-bends which would naturally form stagnant pools.

Leaking valves . . . Sulfuric acid was attacking ordinary packing on control valves in this same acid circulating system on unit contactors. Deterioration of the packing permitted leakage and also resulted in frozen valves and faulty operation. The sit-



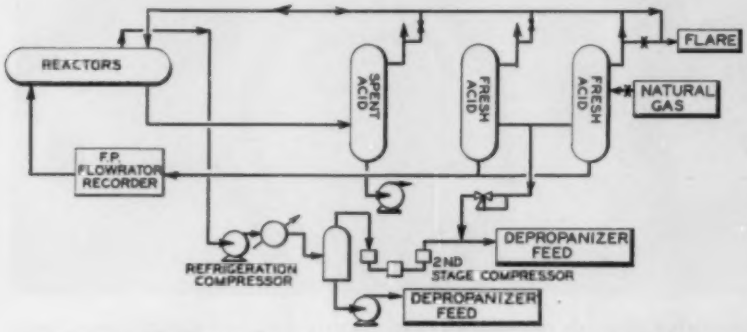
D. P. CELL FLOW TRANSMITTERS were installed across the orifice flanges on sulfuric acid flow lines.



CONTROL VALVES were equipped with a bellows seal gland to prevent acid leaks.

Blitzing Alkylation Problems

uation was met by converting the control valves to equip them with a bellows seal gland designed by Foxboro Co. The bellows is constructed of 316 stainless steel and is fitted to the valve stem so they travel as a unit. In this manner line fluid—acid—stays within the internal bellows. The alloy is acid resistant and is unaffected by the acid surroundings. In case of a leak through the bellows, an outer ring of packing is used around the seal gland to prevent acid from spraying outward. This modified valve has performed for several years without sticking or deterioration of the bellows seal.



REFRIGERATION GAS is used at one installation to pressure blowdown tanks.

Problem: Operating an Acid System

Solution: Use refrigeration gas to pressure the blowdown tanks, change pumps.

Discussion: A problem cropped up on the blowdown system in an acid feed system consisting of two fresh-acid tanks and one spent-acid tank. In order to feed the acid to the reactor, operating at about 30 lb., 60-70 psi. was required on the fresh-acid tanks. Natural gas was used for pressuring the tanks. However, when a drum was emptied, the gas was relieved to the flare system and this resulted in an undesirable flame. The gas was then relieved into the reactor, but this also proved unsatisfactory.

A decision was then made to use some of the refrigeration gas for blowdown. In the operation of the refrigeration cycle, gas is pulled off the reactor, and passes through two stages of compression. Some of the liquid from the first-stage accumulator is returned to the reactor as a refrigerant, and the remainder is used as depropanizer feed. Gas from this accumulator passes into the second-stage compressor. The output from here, at 250 lb., also serves as depropanizer feed. A sidestream is taken off, however, and used to pressure the fresh-acid blowdown tanks, first passing through a pressure regulator. When an acid tank is emptied, the gas is relieved to the reactors. There is no blowdown gas sent to flare. Also, since the gas was originally pulled out of the reactor there are no contaminants introduced into the reactor.

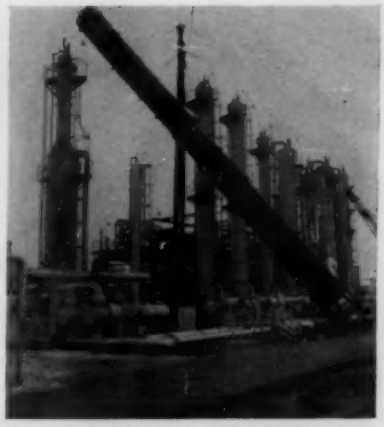
Another change involved the addition of a magnetic rotometer recorder controller for determining the flow rate to the reactor. Before, tank gages had been used, but these were not too accurate with the movement of more than 300 tons of acid daily involved. These meters provide instantaneous accurate readings.

In operation of the alky unit, fresh acid is used to process propylenes and amylenes, and then the spent acid is sent to another unit for processing butylenes, after which the spent acid is regenerated. The spent-acid drum receives acid from the reactor and floats on reactor pressure. Previously a rod pump had been used for moving the acid to the other unit. A packing problem resulted in high maintenance costs. This rod pump was replaced with a Wilfley centrifugal pump, and this curtailed the maintenance problem.

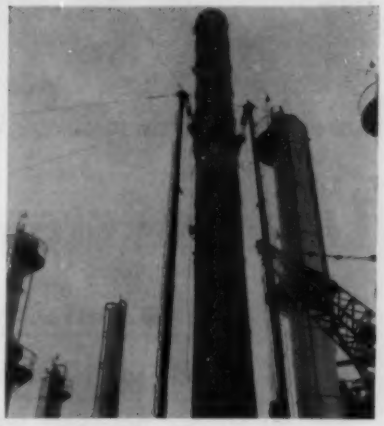
No. 3 in Series

The next installment in this series will be devoted to corrosion in alkylate fractionators. Corrosion is a major problem in equipment downstream from the reactors since reactor effluent contains some free acid. This article will appear

April 22



Isopentane Tower



Installed at Winnie

Will up production of premium-gasoline blending stock

TEXAS GAS CORP. has installed this 114-ft. isopentane tower at its Winnie, Tex., gasoline plant to increase its production of premium-gasoline blending stock.

Russell M. Riggins, Texas Gas president, said the tower is expected to have a production capacity of about 350 bbl. of pure isopentane daily. It will boost the plant's total capacity to 475 bbl. per day.

The isopentane tower, largest and tallest at the plant, contains 60 bubble-cap trays. It was engineered and designed by Winnie plant engineers.

The plant processes 200 M.M.c.f. of gas per day. Products include finished gasoline, L.P.G., butane, isopentane, range oil and gas oil. All natural gasoline is blended into the finished gasoline pool.

Gasoline production is 160,000 gal. per day, and L.P.G. output is 110,000 gal. per day.

Always a hard field to develop because of high pressures and highly faulted conditions, now

Liner Failures Harass Ventura Operators

Here are the current headaches . . .

- Mechanical deformation of liners
- Sand production, which clogs or cuts out liners
- Deposition of asphaltenes in bore hole, tubing, and surface equipment

by D. H. Stormont
District Editor

HOW to deal with frequent well failures in deep zones is troubling operators in Ventura Avenue field, Coastal California.

Always a difficult field to develop, Ventura's hazards have become more complex as wells were drilled deeper and deeper. They stem largely from the abnormally high pressures met and the highly faulted, highly stressed condition of the producing zones.

Current headaches center around pipe troubles opposite the producing horizons in the D-7 and D-8 zones. They are: (1) mechanical deformation of the liners, which will be the principal subject discussed here; (2) sand production, which clogs or cuts out the liners; and (3) deposition of asphaltenes in the bore hole, liner, tubing, and surface equipment. They may or may not be interrelated, but all are often present in the same well.

The cost . . . Ventura operators are spending around $6,000,000 annually to repair deep wells which have failed from one or more of these causes. The solution, particularly in preventing pipe collapse, may be costly.

The general situation tends to jeopardize any deeper development in the field. Ventura sediments are estimated to be as thick as 40,000 ft. Deepest development to date has been to around 16,000 ft.

In view of the severity of failures in the D-8 zone, which have been much worse than in the D-7, operators do not look for conditions to improve with deeper drilling. This fact has prevented exploration below the Pliocene beds.

Three wells have explored part way into the underlying Miocene. The scanty information gained indicates that plugging and mechanical failures will be many times as severe as those so far experienced in the D-8 zone. . . And some 60 per cent of the D-8 wells already have failed at least once since their completion in 1953 or later. Solution of the D-8 problems thus holds the key to all deeper drilling, as well as complete development of the zone itself.

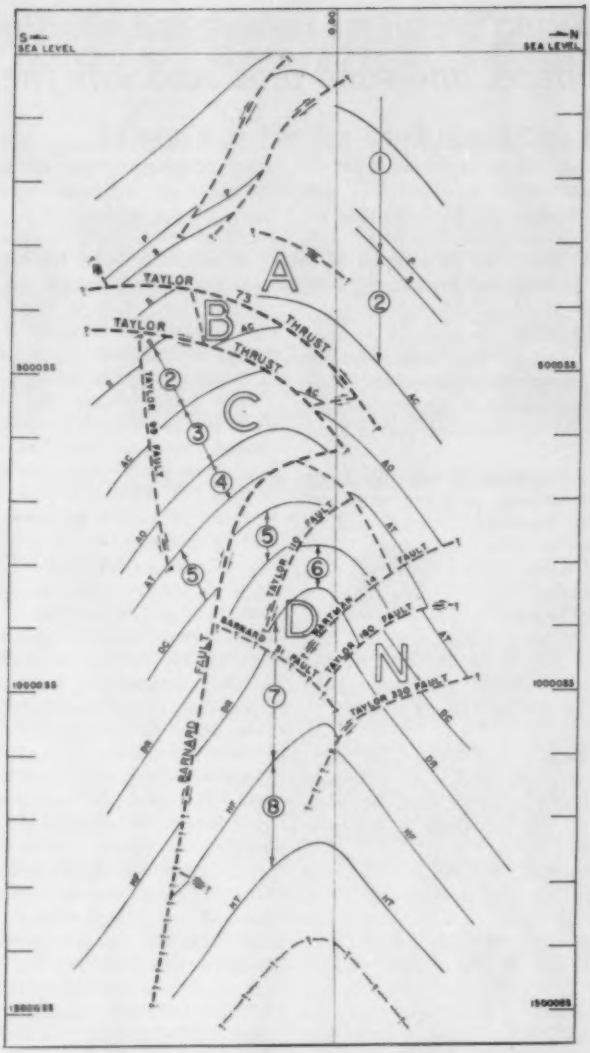
Field Characteristics

Before taking up the problems and steps taken to combat them, a brief discussion of the field is in order.

As in many other California fields, Ventura Avenue is comprised of several separate oil reservoirs piled one on top of the other. Accumulation of oil is controlled partially by the Ventura anticlinal fold. Almost equally important are the many thrust faults which are nearly all confined within the anticline. As is shown in the accompanying typical cross-section, this faulting has resulted in some zones being repeated as many as four times.

The entire producing section has a stratigraphic thickness of almost 6,000 ft. Of this section about a third to a half is net effective pay. Thickness of the zones, which have been somewhat arbitrarily divided and numbered

PRODUCING



TYPICAL CROSS-SECTION through the field indicates the highly stressed conditions which have been set up by severe faulting and folding. The numerals show the various pay zones, some of which are repeated as many as four times in some sections of the field.

1 through 8, ranges from 500 to 1,000 ft.

The producing sections are made up of a rather monotonous series of alternating sands and siltstones, interspersed frequently with hard sandstones. The sands are generally poorly sorted, often quite pebbly, and contain much of interstitial clay.

Oil-sand permeabilities vary, depending upon degree of compaction and clay content. They range from several hundred millidarcies in the shallower formations to less than 10 md. in the D-8 zone. Porosities average from 23 to 17 per cent.

High pressures . . . Long considered a high-pressure field, Ventura Avenue has extreme conditions in the D-7 and D-8 zones. Initial reservoir pressure in the D-7 is estimated to have been about 8,300 psi. at a subsea depth of 9,000 ft. This is well above the hydrostatic and approaching the commonly accepted geostatic gradient of 1 psi. per foot. Pressures in the D-8 have been reported in excess of 9,000 psi.

The field is generally considered to be under a solution-gas drive. This is based on increasing gas-oil ratios and the absence of edge-water encroachment in the older, shallower zones. There is some evidence of gravity drainage.

D-7 and D-8 Development

Active development of the D-7 zone started in 1943 and that of the D-8 in 1953. By the first of 1953 a total of 168 producers had been completed in the D-7. During the next 2 years, 70 wells were completed in the D-7 and D-8. Only 19 were completed in 1955 and about 12 in 1956.

Of the 240 wells completed in these two zones, about 55 are producing solely from the D-8. Some of the others are producing from both zones but most are D-7 wells.

Bottomed at depths of 11,000 to 15,000 ft., these producers have some 600 to 2,000 ft. of producing interval. Cost of drilling and completing them varied from about $250,000 to more than $400,000.

Well failures . . . Some 60 per cent of these wells have failed at least once since their completion, due either to liner collapse, sand problems, or asphaltene plugging—or combinations of all three. Mechanical failures have been most severe in the D-8.

An example of the expense of remedial work is offered by one D-8 well. Completed in December 1953 at a cost of $407,000, in July an additional $82,000 had to be spent on a workover job which involved running a 3½-in. liner inside the old 5-in. Average cost of redrilling these deep wells is about $100,000. That for a cleanout is approximately $30,000.

To combat the well-failure problem, several experimental completion techniques have been tried. These include: (1) gravel-packed liners, (2) open-hole gravel packs, with no liner installed, (3) wire-wrapped liners, both in open hole and inside old liners, (4) high-strength liners using pipe as heavy as 1-in.-thick wall, and (5) liners with stress-relief joints. In addition to these mechanical operations, careful production practices are followed as is later discussed.

Liner collapse . . . Mechanical failure of liners in the D-7 and D-8 zones is believed to be due to forces resulting from the highly stressed conditions of the subsurface formations. This condition results in estimated maximum lateral crushing forces of approximately 13,000 psi.

A comprehensive mathematical analysis made by one operator on the tectonic stresses in the deeper zones resulted in the following set of theoretical conclusions:

1. The subsurface formations are in a highly stressed condition.
2. The presence of a well bore creates a stress concentration in the surrounding rocks.
3. Production of fluid creates additional stresses around the bore hole which are closely related to the decline of bottom-hole pressures.
4. The stresses are large enough to

"Principal producing problems involve the handling of paraffin, asphaltene, and sand produced with the oil."

cause failure of the rock by plastic flow in the case of siltstone, and by shear fracturing in the case of sandstone.

5. Bottom-hole-pressure fluctuations could be very important in aggravating sand production.

6. Mechanical liner failures are probably the result of lateral crushing by rock material being forced into the hole.

The low permeabilities of the producing zones probably worsen this situation. Difference between static and producing pressures may exceed 4,000 psi. in some wells. The high pressure gradient at the well bore, combined with the compacting forces of the overburden, are believed to result in stresses exceeding the strength of even a well-consolidated sand, causing it to spall and slough.

Numerous caliper surveys support these conclusions. They reveal cavities opposite sandstone, where they have spalled and sloughed; and protrusions opposite shales and siltstones.

... Remedial efforts are mainly confined to three experimental techniques: (1) use of heavy-walled, high-strength liners, (2) elimination of liners in the producing zones through use of open-hole gravel packs, and (3) providing stress-relief joints in the liners.

Regarding the latter, one company plans to install slip joints at intervals throughout a heavy-walled liner string. Their purpose is to allow the liner fredom of movement, and thereby relieve the high vertical compressive stresses induced by compaction of sediments. These forces, combined with the radial compression, promote more rapid liner collapse.

... Heavy-walled liners (without slip joints) have been installed in six D-8 wells. Tubular stock of 4140 steel with 1-in. wall thickness (5-in. o.d. and 3-in. i.d.) was used. Perforations were provided by drilling ⅝-in. holes, spaced 80 per foot. Strength of the liner approaches that required to resist the maximum stress to which the pipe could be subjected in the deeper zones.

The 1-in. wall liners haven't been in service long enough to judge how well they prevent collapse. Longest period such a string has been in service has been about 1 year. However, where these wells have been reentered for cleanout purposes, there were no indications of mechanical failure.

Are expensive . . . If heavy-walled liners solve the collapse problem, their general use will be expensive. Cost of the tubular stock is about $13 per foot. Providing the perforations and a special hanger joint adds about $13 more per foot. To so equip a well having a 1,000-ft. producing zone thus costs about $26,000.

To cut costs, the operator is considering running a nonperforated liner through the producing intervals. After it has been cemented, jet perforations then would be provided opposite oil sands.

Use of heavy-walled liners does not solve the tubing plugging problem. Next step therefore probably will be to apply a wire wrapping. Wire-wrapped liners (with a 0.012-in. slot) have worked well in some Ventura wells in combating sand problems. Galvanized wire wrapping would add about $8 per ft. to the cost of the heavy-walled liners. A stainless-steel wire wrap would add about $16.

Gravel pack . . . Only limited experience has been had with open-hole gravel packs and no liner, so evaluation of this technique is not possible now.

The method was tried in a D-8 well completed in the summer of 1956. Completed "barefoot," the well tested 700 bbl. daily through an 8/64-in. choke before it was gravel packed.

After 3-16 gravel had been circulated in the hole with oil-base mud, the well tested 250 bbl. daily. Two months later it was capable of flowing only 40 bbl. daily.

In mid-November the well was reentered to learn whether the decreased production was due to the gravel pack failing to support the walls of the hole, or if it was due to asphaltene deposition. However, in drilling out the liner hanger, portions dropped into the hole and caused the bit to sidetrack the old hole. Thus effectiveness of the method was not determined.

That oil production was being hindered in the old hole was evidenced by the fact the well was recompleted, with no liner or gravel pack, for an initial oil production of 215 bbl. daily through a 10/64-in. choke. Tubing pressure at the time of recompletion was about 1,400 psi.

Producing practices . . . Principal producing problems involve the handling of asphaltene, paraffin, and sand produced with the oil. These settle out of the fluid, bridging the tubing string or plugging the surface bean. To maintain sufficient upward velocity in the tubing, wells are produced at relatively high rates.

On the other hand, too high a rate often results in excessive sand bridging and liner failure. Delicate control somewhere between these extremes is required if the wells are to produce steadily.

New high-pressure D-7 and D-8 wells are produced through small chokes (some as small as 6/64 in. have been used) during early months of their life. After this time the choke size can be slowly increased without fear of harming the well.

... Sand problems tend to increase as wells become older and their output declines. To stabilize flow rates and maintain uniform upward velocities in the tubing, dead crude oil is being recirculated in many wells. Depending upon the size of the well, from 20 to 50 per cent of its output is tank oil which has been reinjected down the casing annulus under pressure. This practice has been found quite helpful in coping with the sand-bridging problem.

... Production packers are widely used to eliminate the tendency for gas to blow around through the tubing after the intake pressure has dropped below the bubble point of the gas. When the tubing is completely filled with gas, expanding gas can blow around and cause a severe shock situation in the bore hole.

Another step being taken in an effort to live with the bad sand condition is to prematurely apply gas lift. This keeps producing rates and flow velocities high, resulting in the bore hole being kept free of bridging. In some instances where the liner had become almost filled with sand, the wells were restored to production by applying gas lift.

Varied methods are used in coping with paraffin and asphaltene deposits. In regard to the latter, the method most used is to wash the liner with solvent. Plastic-coated tubing was not too successful in preventing paraffin plugging in the few wells in which it was tested.

Acknowledgment

Much of the aforegoing discussion was taken from a syllabus prepared for the October 1956 field trip of the Southern California petroleum section of A.I.M.E.

Are We Waiting Too Long on Cement?

Here's how to reduce that costly WOC time

Recent improvements in well completions have reduced rig time required to prepare for drilling-out or completion operations after casing is cemented. All of this time saving cannot be realized, however, unless the time customarily allowed for cement to set and gain strength is reduced. This study indicates that present "waiting-on-cement" time can be reduced without harming well operations.

by S. H. Davis and J. H. Faulk

EARLY-DAY operators reportedly waited as long as 7 days for cement to attain strength. For many years this waiting period was 3 days. Although practices vary to some degree, 24 hours seems to be the most popular waiting period at this time. Waiting time could safely be reduced even more. This article shows that:

1. Industry waiting-on-cement practices are not commensurate with modern oil-well-cement technology.
2. Substantial savings in rig time can be made by reducing waiting-on-cement times now used.
3. Waiting-on-cement intervals, in most instances, can be reduced to 12 hours without adversely affecting well operations.
4. An effort should be made on the part of industry to have state regulations covering waiting-on-cement times altered to permit the use of reduced waiting-on-cement intervals.

Cement-quality control, improvements in casing-cement methods, technological improvements in drilling and completing wells, and progressive experimentation with cement-waiting periods have all contributed to change in practice. The saving in well cost resulting from past reductions in cement-waiting times has enabled the industry to drill a large number of additional wells. The cost reduction also, in effect, has added to the recoverable reserves by making certain marginal reservoirs economically exploitable.

What WOC is . . . The term, "waiting on cement," hereinafter referred to as WOC, usually refers to the period beginning when cement is placed and ending when further work is started toward completion of the well. Thus, on surface pipe, WOC starts when the plug is down with cement in place around the casing and ends when drilling out of the plug is started. On production casing, if the drilling rig is used in completing the well, the WOC interval begins when the cement is placed and ends when the well is perforated or when drilling out begins.

Recent improvements in completion practices have served to further reduce the time required, after casing has been cemented, to prepare for drilling out or completion operations. In fact, in most instances a well can be ready for perforating in considerably less time than the 24 hours customarily called for.

With the possibility of further monetary savings as an incentive, a study was undertaken to determine if present WOC intervals could be reduced safely. The study consisted primarily of comparing cement-strength requirements and experimental cement-strength data to arrive at a minimum safe WOC intervals. At the same time, progressive experimentation was carried out in the field on a limited scale. This paper covers the results of this study. Official state regulations covering WOC intervals are reviewed briefly also, to show their impact on field practices.

Authors are with Atlantic Refining Co., Dallas. Paper presented at the 1957 spring meeting of the Southwestern District, A.P.I. Division of Production, Dallas, under the original title, "Have Waiting-on-Cement Practices Kept Pace With Technology?"

Cement-Strength Requirements

Before the question, "have WOC practices kept pace with technology," could be answered, it was necessary to determine from an engineering standpoint how much waiting-on-cement time is actually needed for oil-well cements to attain sufficient strength to perform their function. The first step was to determine what strength a set slurry must attain to perform the following functions:

1. Secure the pipe in the hole.
2. Withstand the shock of drilling and perforating.
3. Isolate permeable zones at the well bore.
4. Confine initial fracture pressure to the desired zone.

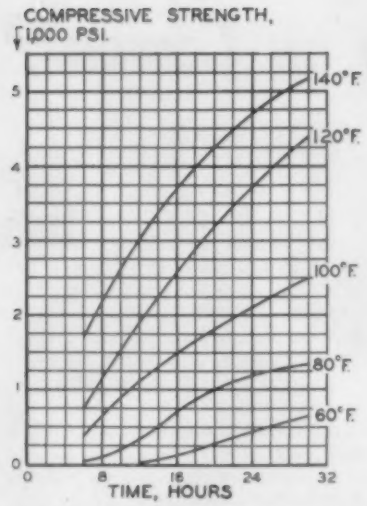
Secure pipe . . . Farris[1] reported the results of tests on the bonding strength of cement to casing. These tests indicated that a cement tensile strength of only 8 psi. or a compressive strength of about 50 psi. is more than adequate to suspend casing. Perforating tests performed by the industry indicate that a low cement compressive strength (about 50 psi.) is probably better than a much higher compressive strength for best results.

This conclusion is based on the fact that less shattering occurs when perforating a low-strength cement. In some instances, somewhat greater penetration and hole diameter are also obtained.

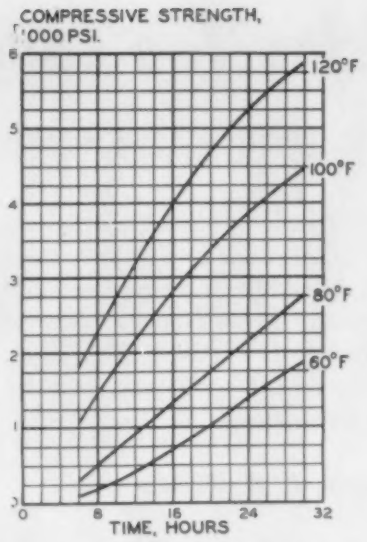
Isolate zones . . . Sample calculations have been made to determine cement strength necessary to prevent the flow of extraneous fluids into the perforated interval. Using assumed severe conditions, these calculations show that a cement shear strength of 80 psi. or a compressive strength of about 130 psi. should be adequate for this purpose.

Mechanistic considerations suggest that actually the problem of confining fracturing pressure or excluding extraneous fluids is dependent upon the seal between the cement and the formation and is nearly independent of cement strength. In addition, it appears that orientation and extent of an induced fracture will be the same whether the cement compressive strength is 50 or 5,000 psi.

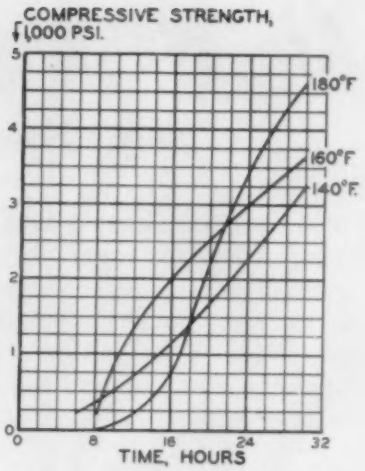
Withstand shock . . . The cement strength required to withstand the shock of drilling, of course, depends upon the contractor's drilling practices. When only drill-collar weight is used on the bit in drilling the plug and enough hole to bury the drill collars, a compressive strength of about



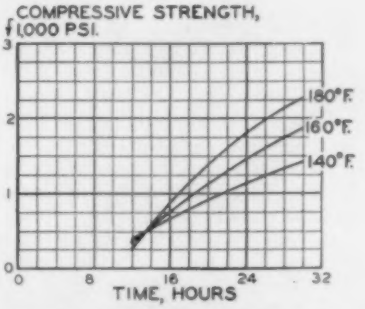
COMPRESSIVE STRENGTH of neat common cement. Fig. 1.



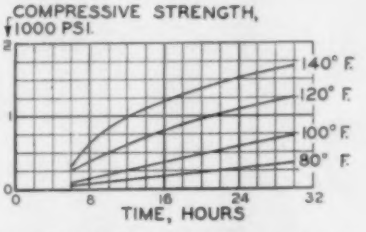
COMPRESSIVE STRENGTH of neat common cement with 2 per cent calcium chloride. Fig. 2.



COMPRESSIVE STRENGTH of neat slow-set cement. Fig. 3.



COMPRESSIVE STRENTH of neat slow-set cement with 4 per cent bentonite. Fig. 4.



COMPRESSIVE STRENGTH of 50-50 mixture of pozzolan and common cement. Fig. 5.

50 psi. is theoretically sufficient.

However, when drill-pipe weight is used on the bit with high rotary speeds, the shock loads induced may cause even high-strength cement to fail. The necessary cement strength before drilling out after a high-pressure squeeze job is uncertain. Judgment, however, suggests that this strength need not be greater than when drilling out the plug or perforating.

Safe strength . . . The oil industry generally recognizes that high cement strengths are not necessary to give satisfactory performance. Different companies have set up different minimum strength requirements. However, most industry personnel agree that a compressive strength of 500 psi. is adequate for all operations. This value probably has a safety factor of from 2 to 5. With reasonable supervision of cementing and drilling out operations, a cement compressive strength of 300 psi. will probably possess sufficient safety factor to be satisfactory.

Cement Strengths Attained

The time required for a cement mixture to attain a specific level of compressive strength depends mostly upon its composition and the temperature of the environment in which it cures. Pressure to a lesser degree also influences the time required for cement to gain strength. Figs. 1, 2, 3, 4, and 5 are graphs which show the compressive strengths vs. time and temperature for the following five cement mixtures:

1. Common portland cement.
2. Common portland cement with 2 per cent calcium chloride.
3. Sloset cement.
4. Sloset cement with 4 per cent gel.
5. 50-50 mixture of pozzolan and common cement.

Even though these graphs represent only a small fracture of the total number of cement mixtures being used today, they will serve for illustrative purposes.

Safe time . . . It may be noted from the graphs that the compressive strength of these mixtures is 500 psi. or greater in 12 to 15 hours for the usual temperature ranges in which they are used. This indicates that drilling-out or perforating operations usually could be carried out safely 12 to 15 hours after the cement has been placed. In some instances the time interval could be considerably shorter.

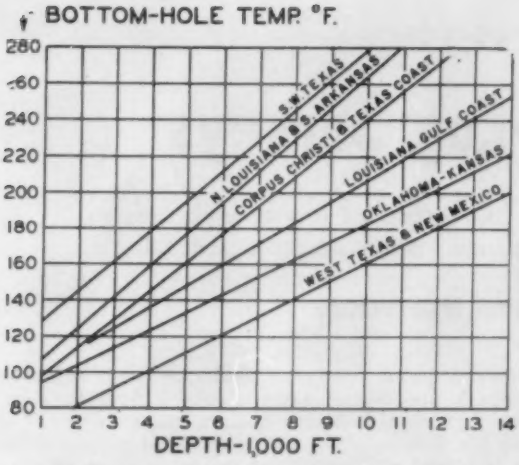
There are situations, however, such as low formation temperatures and subnormal mixing-water temperatures (encountered in the Rocky Mountain area) where 12 to 15 hours may not be sufficient to attain desirable cement strengths. These situations will involve only a small percentage of the total casing-cementing operations performed and need not influence practices under normal conditions.

Fig. 6 shows several temperature-gradient curves which were prepared from temperatures recorded during bottom-hole-pressure surveys. Curves such as these are useful in determining the bottom-hole temperature when specific information is not available.

Minimum WOC Intervals

Certain operations such as nippling down, nippling up, and running logs (in the case of production strings), must be carried out following most cement operations. To eliminate all possible nonproductive rig time, the WOC time required should not exceed the time consumed to perform these operations. Progressive experimentation by various operators has indicated that WOC time can be reduced to the point that nearly all nonproductive rig time can be eliminated. The minimum WOC time possible is dependent to a certain extent upon the type cementing operations being conducted.

A. Surface casing . . . Drilling-out operations can usually begin within 12



BOTTOM-HOLE TEMPERATURE vs. depth. Fig. 6.

hours after the plug is bumped on surface casing. Because of the temperatures involved, this may require the use of common cement with calcium chloride to accelerate the setting action of the cement.

Nippling-up operations must usually begin within 4 to 8 hours after the plug is down, for the rig can be ready to test pipe and drill out in 12 hours. Experiments in the field indicate that in some instances the cement has gained sufficient strength to permit nippling-up operations to begin within 4 hours after the plug has bumped, and drilling-out operations can be started as early as 6 to 8 hours after the plug has bumped.

In an operation such as this, however, an engineer should maintain close control over all variables. With the exception of cold-weather operations, it appears that with the use of proper cement mixture, drilling-out operations can be commenced 12 hours after the plug has bumped on surface casing.

B. Intermediate casing . . . This type of casing string, which is usually hung in full tension, is not as critical in many respects as surface casing. It is usually possible to release pressure immediately and begin nippling-up operations. Consequently, constructive work is in progress while the cement is gaining strength to hold the pipe rigid in the hole.

The rig can seldom be ready for testing and drilling-out operations in less than 12 hours. In most instances the cement will attain adequate strength within this 12-hour period.

Exceptions to this may be subnormal temperature circumstances where low-density and thus low-strength cements are used. However, this exception can be eliminated in many instances by using a small volume of high-strength cement around the casing shoe.

C. Production casing . . . Most production casing strings are being hung in full tension. This practice became more general after the publication of A.P.I. recommendations.[2] It has made possible considerable savings in rig time during well-completion operations. Constructive work can now be performed while waiting on cement and preparing to perforate.

As previously pointed out, it appears that a cement compressive strength of 500 psi. is more than adequate to withstand perforating and testing. In most instances this would require a waiting time of 12 to 15 hours after the plug has been bumped.

With supervision and proper selection of cement slurry, perforating and testing in some instances could be carried out satisfactorily as early as 6 to 8 hours after bumping the plug. However, it is seldom that all the necessary work preliminary to perforating can be completed in less than 12 hours after bumping the plug.

D. Drilling out after squeeze . . . The cement-strength requirement for drilling out following a high-pressure squeeze is uncertain. Additional experimentation to better establish this requirement appears desirable. Immediate washout or drillout appears to have some merit. However, a WOC interval of 12 to 15 hours, based on similar requirements for completing or drilling out the plug, should allow for ample cement strength.

Table 1 gives the WOC times required by several states for the various casing strings. In some states these regulations are enforced and in others they are not. Whether enforced or not they have the impact of being a strong argument for maintaining present WOC practices.

Calculations have been made to show the cost of WOC time called for by state regulations which is in excess of the minimum times set forth in this paper. The requirements of Texas regulations (24 hours) were used for these calculations. Using a minimum WOC time requirement of 12 hours, there would be 12 hours of excess time required for each string cemented. Using an average cost of $30 per hour for rig time, the excess cost becomes 30 times 12 or $360 per string. Where both surface and intermediate casing are set in addition to the producing string, the total excess cost becomes 3 times $360 or $1,080 per well.

Experimental Field Practices

Experimentation in the field by various operators supports the conclusion that the WOC time, after casing-cementing operations, can be safely reduced to 12 hours. On an experimental basis, nippling-up operations have begun on surface casing 3 hours after bumping the plug, and the drilling-out operations have started 8 hours after the plug bumped.

Even though most intermediate strings are hung immediately after cementing, the time required to nipple up and pick up drill pipe generally exceeds 12 hours. However, producing strings have been perforated successfully for production 10 hours after the plug was bumped. Experimental high-pressure squeeze jobs have been obtained even though the cement was washed out immediately at the completion of the squeeze job.

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TABLE 1—WOC INTERVALS REQUIRED BY STATE REGULATIONS

State—	Surface casing	Intermediate casing	Production casing
Texas	24 hours	24 hours	24-48 hours
Louisiana	12 hours	(*)	24 hours
New Mexico	24 hours	30-48 hours	30 hours
Oklahoma	12 hours	Not covered	Not covered
Mississippi	12 hours	Not covered	24 hours

*Rulings made on individual-well basis.

New method of interpretation gives you

More From Your Dip-Log Surveys

System is designed to give geologist a full record of entire well, and to locate points where faults, unconformities, etc., occur in geological column

by Curtis Franks and Bill White

A NEW method of interpreting continuous dip logs has proved highly successful in both salt-dome fields and low-relief structures with dip angles as low as 3°. One of the more apparent features of the method is to locate breaks in the dip trend representative of faults, unconformities, etc. But the increased accuracy obtained by the method is very beneficial in the construction of subsurface maps and cross-sections.

Dip logs are generally thought of as tools to be used only in wildcat wells. However, they will be even more valuable in development wells by helping to reduce the dry holes through a quicker and more complete knowledge of the structural details of the field.

In the early days of dip-log surveys, selected intervals were surveyed. Usually five or six levels were checked near the zone of interest, and dips and strikes of the formations were computed at these levels. Often, due to poor selection of levels, the information resulting from these few stations would be incomplete. Consequently the dip surveys were of little or no value. It was not uncommon to have wide divergence between many of the stations as to magnitude or direction of dip. Trying to use such results was quite similar to contouring with one well control. The final picture was largely the product of imagination.

Later, it was realized that if many more stations, perhaps 15 or 20, were taken over a longer interval of the hole, the chances of getting useful information were greatly increased. Some attempts were made at this time to present a partial structural picture from the dip-log information, but mostly on salt-dome structures. Sometimes it was possible to locate faults or unconformities by changes in dips; however, due to the sparsity and selection of stations recorded, it could not be done in a routine manner. It was often impossible to verify a possible fault or unconformity because of the lack of confirming dip data.

This need for many more dip levels led to the development of the continuous dip log, a survey that logs the entire uncased hole. However, due to the shortcomings of the earlier system of recording only a few stations and its consequent lack of general acceptance, it became customary to calculate only the minimum number of levels—usually 10 to 12—near the zone of interest. Then, with the advent of specialized personnel computing the records, it also became customary to select intervals to be calculated where the best "wiggles" appeared on the dip-survey record—with emphasis on the pay zone and little attention being paid to zones above or below the pay. This random selection of a few stations from the best "wiggles" on the record has caused many geologists to completely disregard the results given from dip surveys. Or else they find the results of very little value because of conflicting dips and strikes; very often these conflicting data represent crossbedding, or other conditions not directly related to the structural geology of the area. Thus, until recently, a large gap existed between the results which were furnished and the results which were actually needed for intelligent subsurface interpretation.

Better interpretation . . . In order to fill this gap between the information furnished and that which was needed, a study of dip-logging methods was undertaken in 1955. Its purpose was to determine if better interpretation could be devised and routinely presented as a part of the service companies' work. A method was needed that would be applicable to all types of structures havnig low or high relief. The technique developed and described here is, in most of its individual parts, not particularly new. However, the routine presentation of these results using all of the techniques together in a **routine** manner is new and is designed to fill this gap.

This interpretation system is designed to present to the geologist a comprehensive record of the entire well. The survey will indicate the magnitude and direction of **structural** dip of all formations, and it will locate as closely as possible the points where faults, unconformities, or other "breaks" occur in the geological column. With this information, the geologist with his intimate knowledge of the area can make his interpretation of the subsurface picture.

The nature of this dip information is quite similar to the data that a surface geologist gathers in walking an area for surface geological study; and the resulting subsurface interpretation from such a surface study depends upon the completeness and accuracy of the original data.

The subsurface geologist using a dip-log survey is working in a vertical, rather than horizontal, plane. But if the dip log is properly interpreted, his **basic data** will be as accurate and probably more complete than might normally be available from a surface study. And more important, his data will include the potentially productive horizons. The problem then becomes one of properly interpreting the dip survey so that these data will be as complete as possible and will reflect the formation dips and not miscellaneous dips from sedimental features.

In practice, this result is achieved by a different technique of calculation, plus a method of evaluating the zones from which dips are computed. Dip results in the past have frequently been furnished from very short intervals; correlations are established between curves on one or two peaks or breaks in the curves. The results were averaged mathematically over a longer section of 10 ft. or more. Experience has shown that th... is an excellent way to study dips and dip changes due to crossbedding, etc. The mathematical average of these dips does not necessarily represent the structural dip.

A better technique of calculation is to correlate the three dip-log curves—obtaining good correlation—over at least 10 ft. of hole and preferably more. In this manner, minor changes due to deposition will not enter into the calculation. Only the predominant

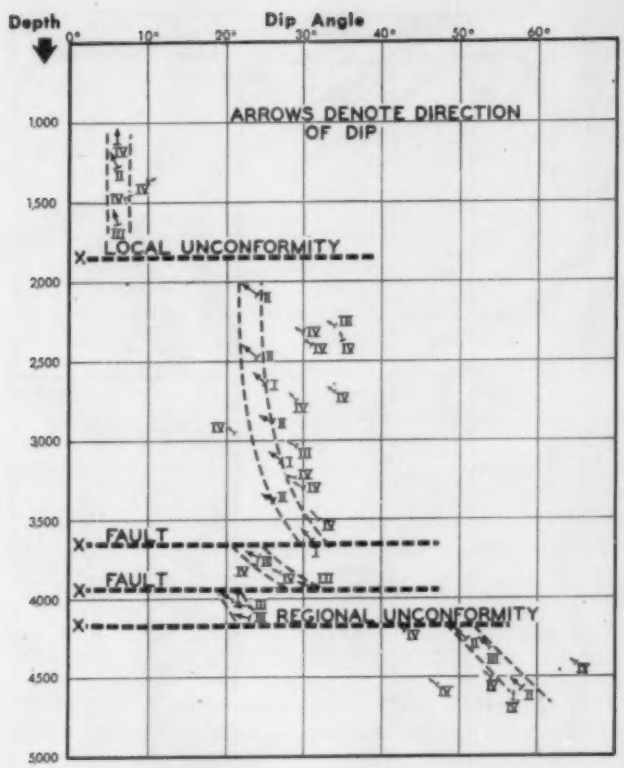

Fig. 1—All of the stations computed are plotted with the Roman numerals designating the relative merits of the stations as explained in the text. Note that the trend lines encompass primarily the best (I) and second best (II) stations. Although many of the III and IV stations are eliminated from the final presentation, they are used to help better determine the depth of the breaks.

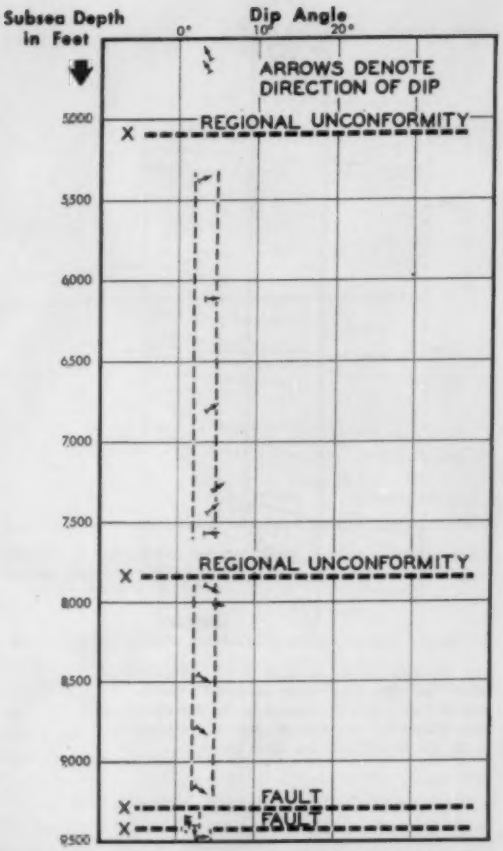

Fig. 2—Graphical interpretation of a low-relief, faulted structure. Note that dips are accurately defined from a minimum of 2° to a maximum of 5°.

structural dips will be computed. Further by calculating in only the better grade of intervals, fewer misleading dips and strikes representative of crossbedding, etc., are encountered.

Classifying data . . . As each dip is calculated, the interval is evaluated by a method which experience has indicated to be trustworthy. The intervals may be classified as being in one of the four groups described below in order of decreasing merit:

I. A dip station that includes a thin, clean sand—say 10 ft. or less in thickness—in the midst of a long shale section should give the best results. The interval must include some of the shale section above and below the sand body. This interval should give the most reliable results, because shales generally represent deposition under quiet waters, and consequently, parallel bedding planes. However, to obtain truly representative dip data, the sand body should be of considerable areal extent, and not a localized lense.

II. The next most reliable station should be located at the base or top of a thick sand body with at least 50 ft. or more of homogeneous shale adjacent and a "clean" contact between the two.

III. In sequence, the next most reliable station usually is located at the base or top of a thick sand body with 50 ft. of similarly homogeneous shale adjacent to the sand body, but where the transition from sand to shale is gradual, extending over a thickness of several feet. This condition is most often found at the top of major sand sections; and the clean contacts as outlined for Class II stations are usually on the base of such sands.

IV. From a structural standpoint, the least desirable station is usually located on lime streaks or thin shale breaks within thick sand bodies where considerable crossbedding is present. However, where several thousand feet of sands is encountered, such as in the Miocene of South Louisiana, it becomes necessary to compute such intervals. In such a case, as many stations as possible are computed. Then, although considerable variations might be found, it is usually possible to statistically delineate a trend of magnitude and direction of dip; this trend

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Halliburton in 1950. Following field experience as trainee and operator in the electrical well services department, Franks was named to his present post in 1953.

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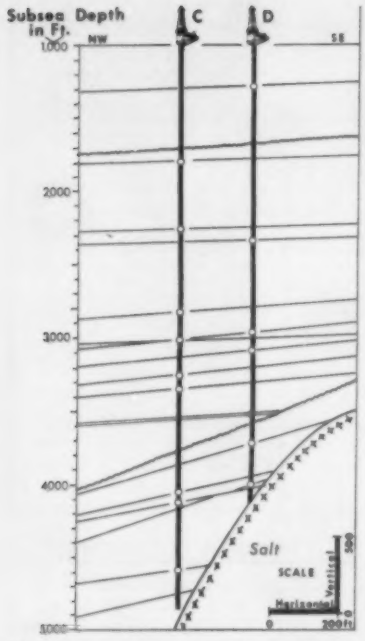

Fig. 3—The circle at each level indicates where the dip data were obtained. Cross-section between wells uses only the dip data. This illustrates the use of dip information as an aid in difficult log correlation.

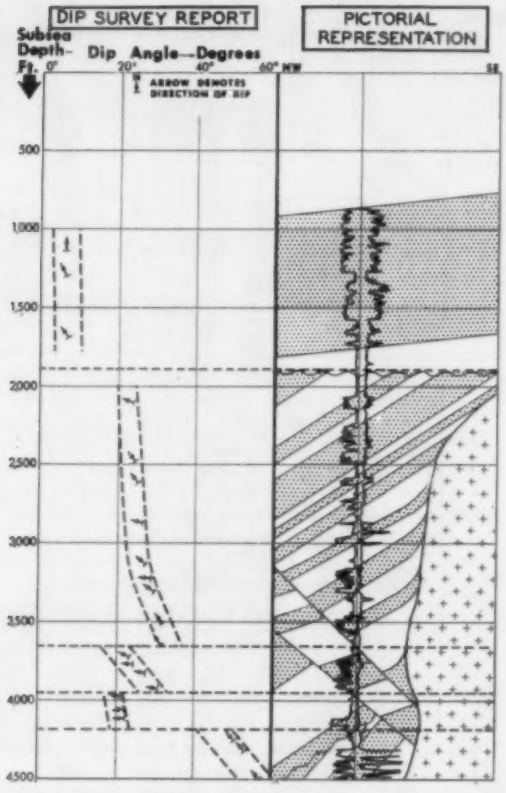

Fig. 4—The complete subsurface picture derived from the interpreted dip log of Fig. 1.

is representative of structure, rather than deposition. Usually, only a portion of the levels through such a section will represent a consistent trend; the remainder will have such wide variations of data as to be structurally meaningless. Another zone, which is also usually classed as a Class IV station, consists of a sandy-shale phase in the midst of a long shale section.

Interpretation of Results

The dip data are selected, graded, and computed. Then the results are plotted on a graph of depth versus dip; an arrow represents the direction of dip as shown in Fig. 1. Next, a tentative interpretation is made. At this point, the interpreter must have an idea of the general regional geology, as well as some information as to the type of structure expected—such as a deep-seated zone, shallow piercement dome, or anticline. However, no specific knowledge of the individual faults, unconformities, etc. to be found in the immediate locality is needed. This generalized geology is necessary, because each type of structure generally has a specific type of trend of dips as the well progresses deeper. Two of these are illustrated in Figs. 1 and 2.

With the preliminary graph and the general knowledge of the structure, it is then usually possible to find at least one interval on the graph where a trend of dips and strikes can be established. Once the first trend is established, it is then relatively easy to determine any interruption of the trend. This is evidenced by either a change in dip or strike, or both. These trends are then outlined; and intervals are selected for additional computations that will verify the preliminary results and locate more precisely the depth of the interruptions. At this stage of the operation, it very often is necessary—due to various conditions—to compute Class II and III intervals. At times, it may even be necessary to compute several stations within a major sand body in order to pin point where the change takes place.

Establishing these trends . . . Variations of dip angle within a single trend of approximately 3° are permitted; and a variation of about plus or minus 22½° in direction of strike. This is particularly true if dip angles are less than 7°. On some surveys where recorded results are excellent, it is possible to maintain a trend "width" of as little as 2° in dip angles with a variation of only plus or minus 10° in direction of strike.

After the additional stations have been calculated and evaluated, a selection process takes place. Many of the stations from the least reliable intervals are eliminated from the final interpretation and presentation. These levels are incorporated in the dipmeter report. But they are eliminated from the graphical presentation of results, since they obscure the trends and interruptions. However, either the dip or direction of dip from some of these rejected stations may be used in locating the depth of an interruption of trend.

It should be realized that this final graphical presentation is actually an interpretation of dip results. For this reason, the final interpretation is usually done by at least two geologically trained men working together. Sometimes, however, the final interpretation can be made only in consultation with the geologist in charge of the well, who is well acquainted with the local geology of the area.

At this point the service company has completed its work and turns over the results of the interpretation to the oil-company geologist. He, and he alone, with all of his subsurface and geophysical information can determine whether an individual break in trends represents a fault, an unconformity, or simply a time break—such as frequently occurs at a change of ages. Nonetheless, knowing the

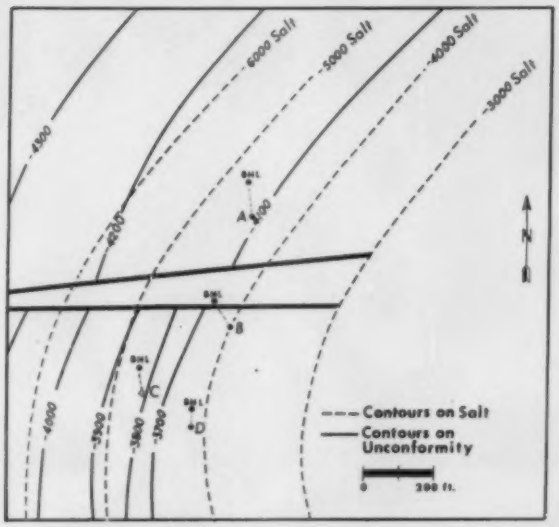

Fig. 5—The best subsurface interpretation possible before the dip logs were reevaluated with the new techniques.

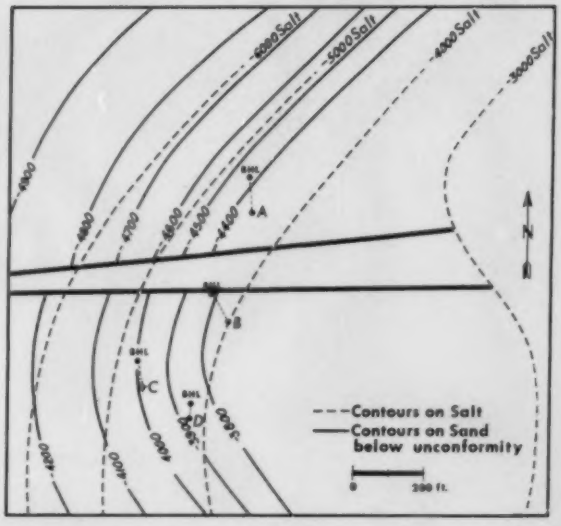

Fig. 6—Resulting subsurface interpretation is based on the interpreted dip-log data (see Fig. 5).

depths at which all of the major breaks in trends occur, the geologist is then in a much better position to complete his structural interpretation of the area.

Examples

An interpreted graph is presented in Fig. 2 from a survey on a very low-relief faulted anticline located in the Texas Gulf Coast. Although none of the dip angles are over 5°, the breaks in the trends are obvious from the changes in magnitude and strike. The **structural** dip is accurately defined throughout each of the sections. Two of the breaks are regional time breaks, and the last two represent faults.

The NW-SE cross-section in Fig. 3 was made from the interpreted dip-log data from wells C and D of Fig. 5. Using **only** the dip data from within the trend lines indicated on the graphical presentations, the dips were projected by descriptive geometry into the common vertical plane between the two wells. The circle indicates the well from which the data originated for each level. The excellent agreement of the dip angles taken from surveys on two wells confirm the fact that true **structural** dips were used.

Fig. 4 is a NW-SE cross-section constructed with the aid of the interpreted dip-log data shown in Fig. 1 from well A. This is the type of cross-section which the geologist would be able to complete with his knowledge of the specific area involved. With this local information, the breaks indicated on the dip-log interpretation were identified as a shallow unconformity, followed by two minor faults, and finally a regional unconformity. The approximate depths of these breaks were indicated by the dip-log interpretation. The exact depths were found by electric-log correlation.

In well A, the pay sands are located below the lower regional unconformity; and the unconformity together with the salt mass seems to form the necessary trap. Note that the dip log and cross-section indicate a similar trap below the upper unconformity which would be tested by a well closer to the dome.

In the same field, several other wells were drilled and dip logs were run prior to the inception of this dip-log interpretation method. Fig. 5 shows the salt contours and contours on the lower unconformity (which was then the lowest correlative point).

With the usual dip-log information, this was the best subsurface interpretation which could be made and was so carried on the oil company's structural map. The dips surveys, which were available on all four wells, were reevaluated by the technique presented. The interpretation from well D showed a "reverse trend" below the lower unconformity—i.e., the dip **decreased** with depth rather than increased. This reverse trend was interpreted as meaning that the salt mass was closer to the well, in a horizontal direction, at the unconformity, than it was at a lower depth. This would tend to indicate either an overhang (which was ruled out by seismic information), or a flattening and perhaps leached-out cavity in the salt face. The latter possibility was eventually verified by a study of driller's logs on wells to the east, which were drilled 30 to 35 years earlier. The changed 3,000-ft. salt contour is shown in Fig. 6. Yet to be verified is the possibility of a changed position on the 4,000-ft. salt contour.

Correlation of three sand zones below the unconformity was established by using the descriptive geometry method of obtaining apparent dips in any given direction from the known true dip taken from the dip-log data. This correlation, together with the appropriate dip-log data established the structural contour on the first of the three sands as shown in Fig. 6. Although this is in general agreement with the original contour of the unconformity (Fig. 5), it is now apparent that southwesterly dip is present in well D, which is located on the west flank of the dome. This, together with the changed salt-contour, will present a considerably different problem for future development work in the area.

Acknowledgment . . . The authors wish to thank the managements and technical staffs of the companies who have cooperated in developing this technique and for their permission to publish the results.

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Table 1—Cost Analysis

Hot-Dip Galvanizing versus Zinc-Silicate Coating in Gulf Coast Area, Transportation Costs Not Included

CASE 1*
(Costs per square foot)

Pipe size (in.)	Galvanizing	Zinc-silicate
1	$0.27	$0.32
2	0.32	0.30
3	0.29	0.30
4	0.29	0.28
6	0.34	0.27
8	0.40	0.26
10	0.41	0.26
12	0.46	0.26

CASE 2†
(Costs per square foot)

Structural steel shapes—	Galvanizing	Zinc-silicate
24WF100	$0.30	$0.26
21WF82	0.29	0.26
18WF64	0.26	0.26
16WF36	0.17	0.26
14WF78	0.36	0.26
12WF65	0.33	0.26
10WF49	0.29	0.26
8WF31	0.23	0.27
6WF20	0.18	0.28

*Assuming 1,000 ft. of standard pipe in 20-ft. lengths. †Assuming 1,000 ft. of steel in 20-ft. lengths.

Table 2—Typical Structural-Steel Plating Costs

(Costs per square foot)

	Case 1—(a) Zinc-silicate; (b) pretreatment; (c) primer, 1 coat; (d) HS vinyl, 1 coat		Case 2—(a) Primer; (b) hot-spray vinyl, 2 coats; (c) vinyl, 2 coats	
	Labor	Material	Labor	Material
Sandblasting	$0.14	$0.10	$0.14	$0.10
Zinc coating	0.10	0.10	.....	.....
Pretreatment	0.01	0.01	.....	.....
Primer	0.04	0.06	0.04	0.06
Body coat vinyl	.....	.....	0.05	0.10
Finish coat vinyl	0.05	0.10	0.05	0.10
Miscellaneous	0.05	.....	0.05	.....
Total	$0.39	$0.37	$0.33	$0.36
Total job cost	$0.76		$0.69	

Table 3—Annual Costs for Typical Structural-Steel Installation

(Costs per square foot)

	Three-coat vinyl system		Zinc-silicate and two-coat vinyl system	
Assumed life, years	5	10	20	30
Initial cost	$0.69	$0.69	$0.76	$0.76
Maintenance cost	0.15	0.30	0.20	0.30
Repaint cost	.....	.....	0.30	0.60
Total cost	$0.84	$0.99	$1.26	$1.66
Cost per year	$0.17	$0.10	$0.06	$0.06

How to make steel last longer

Zinc Coatings . . .

Complete corrosion protection at lowest over-all cost

by F. P. Helms

THE value of zinc as a protective coating for steel has long been well known. Plentiful and inexpensive zinc has been used in paints, as a metallic coating, and as anodes in cathodic protection.

- Modern methods of zinc coating provide a cheap means of making steel last much longer.
- These new methods bring the benefits of the galvanic action of inorganic zinc coatings and at the same time permit use of the coatings as a base or primer for organic coatings.
- Some cost comparisons for different protective methods are given here.

1. Application

Inorganic zinc coatings can be applied to properly prepared steel by several methods:

1. Galvanizing which includes hot-dipping in molten zinc or by electroplating from a zinc salt solution.

2. Application in the field by brushing or spraying of a zinc silicate formulation as a chemically cured reactive liquid.

3. High-temperature deposition of the zinc into the pores of steel.

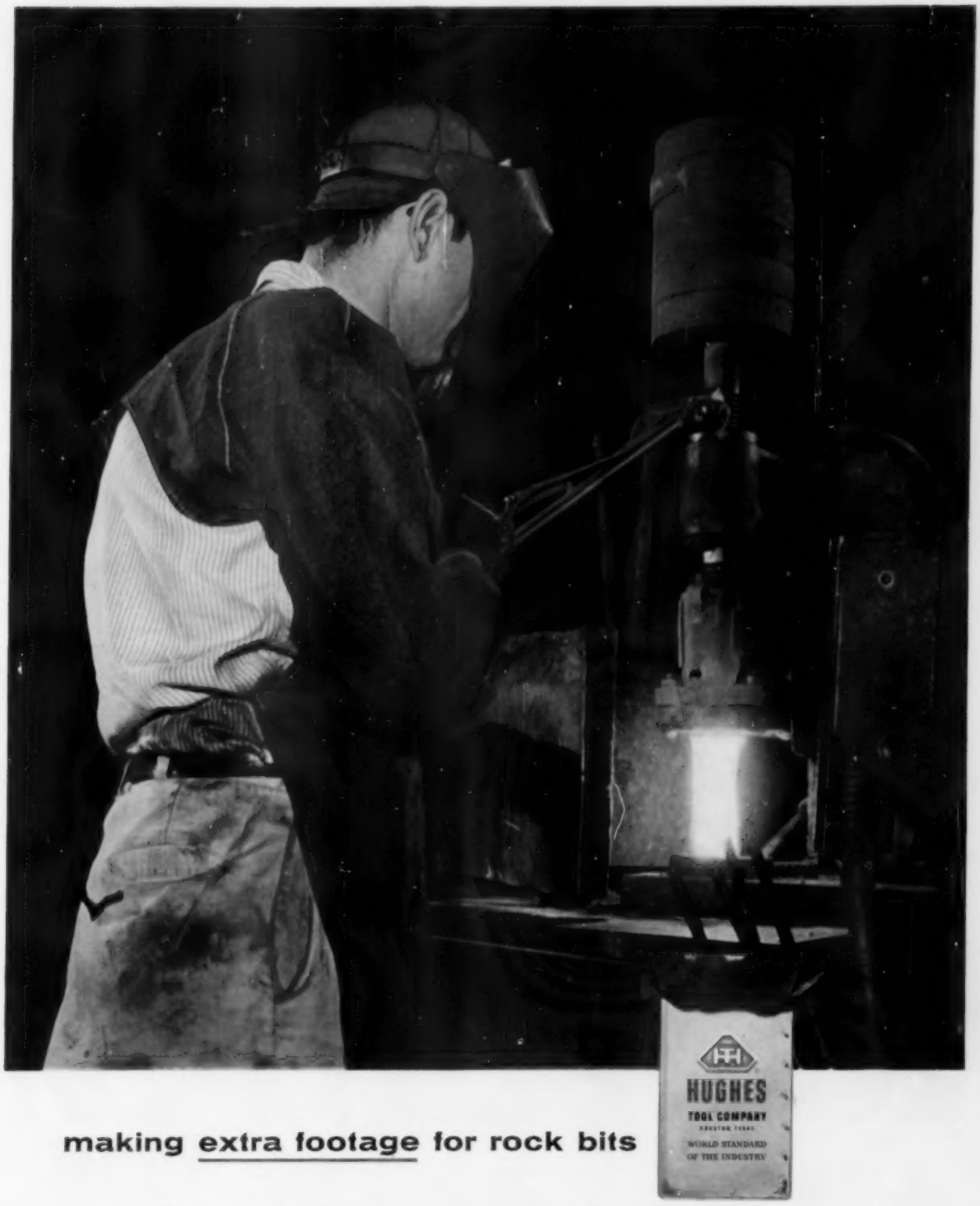
4. Metalizing or flame-spraying of zinc (powder or wire) onto steel surfaces.

Factors . . . Choice of the method of application of inorganic zinc coatings involves many factors, such as inherent characteristics, cost, transportation, availability of facilities, availability of skilled labor, etc. Briefly, some of the methods are:

1. **Galvanizing.** This process offers a highly satisfactory coating at a reasonable cost but involves a permanent facility at high initial investment and therefore not usually found in chemical plants or like industries. As a result, steel to be galvanized must be transported to and from such a facility. Galvanizing is limited in application by the size of steel shapes and by the facility.

2. **Zinc silicate formulations.** Compares favorably with galvanizing in cost and performance (see Table 1). These materials can be applied in the shop or field using ordinary painting equipment. They are best suited for application to large surfaces and equipment which can't readily be galvanized by hot-dipped methods.

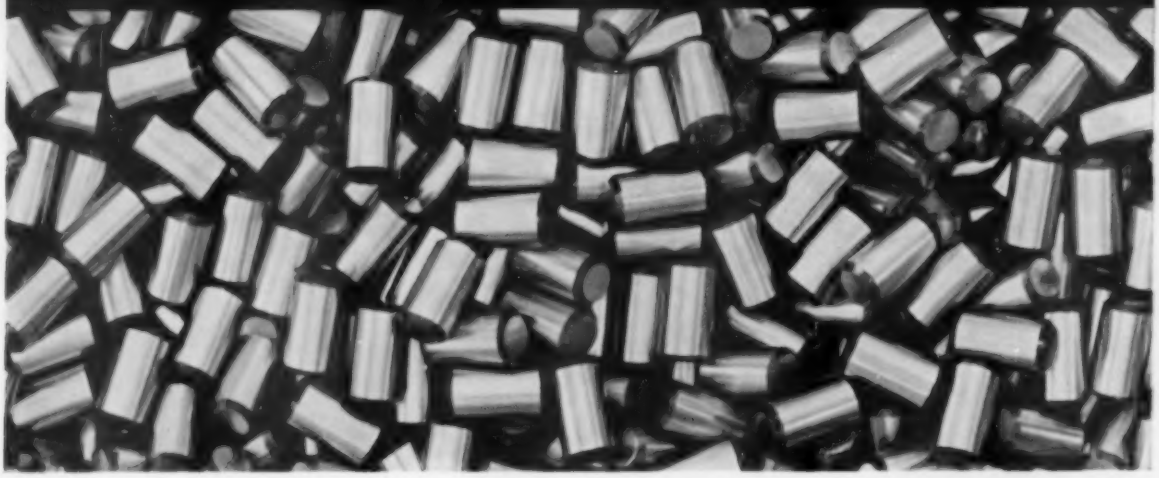
3. **High-temperature deposition** of zinc dust is used for small intricate parts or castings which can be placed



making extra footage for rock bits

The "white hot" metal being alloyed here at over 5000° F., is molten *Hughesite* — one of the hardest known man-made materials. It is 25 times more wear-resistant than hardened steel. *Hughesite* is an exclusive Hughes development. Hughes' methods of applying *Hughesite* to bit teeth and gauge surfaces are increasing the rate of penetration and footage drilled per bit. Here is another example of HUGHES' continuing effort to provide the drilling industry with the best possible tools.

OVER 30 MILLION ROLLER BEARINGS A YEAR...
Individually Inspected!



One hundred per cent inspection (not batch sampling) safeguards the quality of the roller bearings that go into Hughes rock bits. Every one of the more than 30 million roller bearings manufactured each year by Hughes goes through four final inspections.

Each bearing is inspected electronically for length, diameter and hardness, and then subjected to ultra-violet light inspection for surface imperfections not detectable by the human eye.

In addition, the special analysis bearing steel—made to Hughes' specifications—must pass a series of metallurgical inspections before it is accepted. This combination of selected raw materials and finished-product inspections assures the consistent, dependable performance of HUGHES rock bits.

inside the retort. Structural shapes cannot be coated in this manner. The process is for shop use only.

4. **Metalizing** can be applied in the field to any properly prepared steel surfaces by means of an oxyacetylene flame. This method can be used for touch-up work or for very high-temperature coatings, but it is unsatisfactory for general use as an inorganic zinc coating because of the extremely high costs and porosity of the applied film.

Galvanizing or zinc silicate . . . The choice of an inorganic zinc coating as part of a protective system for steel in industrial, chemical, or marine environments is therefore narrowed to galvanizing the application of the zinc silicate. The individual choice between the two thus selected is governed by several factors:

1. Location, size and shape of steel to be coated.
2. Cost comparison.
3. Time requirements.
4. Availability of galvanizing facilities or skilled painters.
5. Characteristics of the two coatings.

Surface - preparation (sandblasting) costs can be as high as 50 per cent of the total protective system costs with the normal cost being 25 per cent to 35 per cent of the total. This high surface-preparation cost is eliminated from future paint jobs by inorganic zinc coatings protected by organic top coats.

In many sensitive areas in industrial plants, sandblasting is not permitted to field installations. This results in constant and costly upkeep of organic coatings. If sandblasting can be done during a shutdown, say, an organic paint job can usually be done during normal plant operations. But the zinc coating must be protected as soon as possible after application to reduce zinc loss and surface contamination.

Overcoating of zinc has many possibilities as well as variations in methods of pretreatment prior to application of organic top coats:

Hot-dip galvanized steel is suitable for overcoating after approximately 1 year of weathering under most conditions. When it is necessary to overcoat immediately, there are two excellent methods of pretreatment:

1. Washing with a weak acid solution such as acetic or phosphoric acid or commercial preparations designed for this purpose.
2. Light sandblasting with low air pressure and very fine abrasive.

The zinc silicate coated steel offers a somewhat simpler solution to the problem of overcoating, in that it can be painted after about 6 months of weathering under most conditions. These coatings may be overcoated within a few days through the use of proper primers or by washing with a weak acid solution.

Once the zinc coating has been treated, the choice of material for overcoating can be made on the basis of exposure since any type of organic paints can be used over the base thus obtained.

One of the better methods for maximum resistance to severe chemical corrosion consists of a bare metal-type vinyl primer applied by spraying (1 to 1½ mils) and followed by one or more coats of vinyl finish applied by hot-spraying (3 to 4 mils per coat).

In the case of certain solvent exposures, where severe chemical corrosion is absent and a color coat is desirable, the zinc coating after treatment can be successfully overcoated with one coat of epoxy type of paint.

In the severe exposures of chemical, industrial, or marine environments, inorganic zinc coatings used as part of a protective coating system offer the best and most economical approach to controlling the problem of atmospheric corrosion.

The following three characteristics clearly demonstrate the advantages of the zinc-organic protective coating system as against a straight organic protective coating system:

1. **Galvanic protection.** In addition to the obvious benefits derived from the basic characteristics, undersurface or underfilm corrosion is absent even on small bare areas. Underfilm corrosion is an insidious enemy of a protective coating which, unchecked, will destroy the organic protective coating system. In preventing any underfilm corrosion, the life and efficiency of the organic protective coating system is lengthened and periodic upkeep is reduced.

2. **Base coat or "primer."** Inorganic zinc coatings, after proper treatment, offer excellent properties as a base which insures greatly increased life and efficiency of the organic top coats. The zinc coatings offer a service as permanent "primer" which never requires replacement.

3. **Permanent surface preparation.** This feature illustrates the most valuable characteristic of the inorganic zinc coatings. Once the steel surface is properly prepared by pickling or sandblasting to receive the zinc coating and the zinc coating is applied by hot-dipping or application of the zinc silicate, no costly future surface preparation is necessary when the zinc is protected by an organic paint.

2. Costs

Since economy is always a major factor in the plant maintenance program, the saving gained by the long-life expectancy of steel when protected by the zinc silicate-organic system, the elimination of costly surface preparation when recoating is necessary; and extended life of the organic overcoats, results in an exceptionally low square-foot per year cost. (As noted, Table 1 compares hot-dip galvanizing and zinc silicate.)

Structural steel painting costs . . . Table 2 shows the initial cost of two protective coating systems as typical for a severe chemical corrosion area. The installation is assumed to be a steel structure previously painted and under various stages of failure with some rusting. The table compares Case 1 with zinc silicate-organic paint system to Case 2 with a straight three-coat organic paint system. This comparison may be developed for any paint system desired: alkyd, oil, epoxy, rubber, etc. The cost of the zinc silicate combination will be 7 to 15 cents per square foot higher assuming both surfaces are sandblasted.

Annual costs . . . As the higher cost of the zinc silicate-organic paint system is applied to a comparative analysis as in Table 3, the square-foot per year cost decreases by a considerable amount. Two assumptions for paint life are made in each of the two systems since the life expectancy of a coating will vary with the material selected, application, and environment. This table, also, should be developed for the individual cost data and life expectancies.

This comparison will indicate the economy of the zinc coating-organic paint system as a greatly reduced square-foot per year cost.

In the case of new construction, hot-dip galvanizing prior to erection should be considered for the zinc coating.

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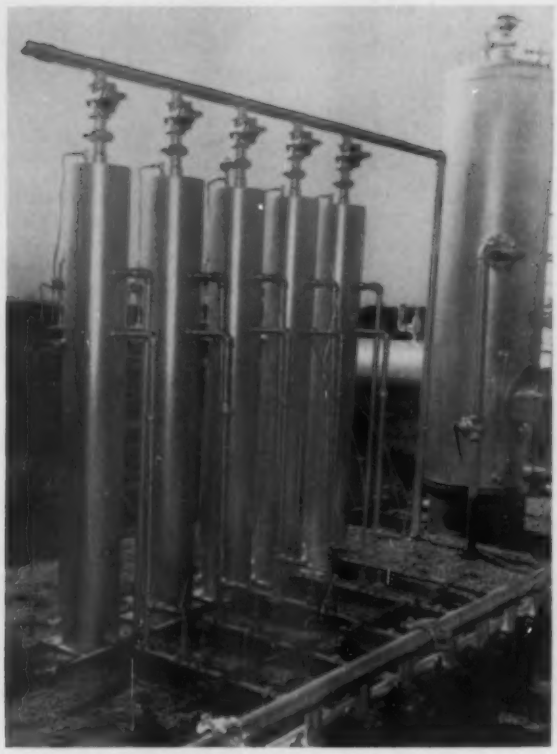


ONE-WELL SEPARATORS handle production from small-volume producing wells, dump in ¼-bbl. increments. Fig. 1.

CONTROLS are actuated by produced gas. A diaphragm-operated counter records each dump. Fig. 2.

How to Get Cheap Daily Tests

The one-well measuring separator developed by Shell Oil Co. can be installed for as little as $300. The device is simple, trouble-free, and sufficiently accurate. Other operators who have large leases with a lot of low-productivity wells could profit by putting these devices to work.

by Ed McGhee
District Editor

EVERY operator who has a big lease with many small-volume producers knows that wherever production drops off, there has to be a well-by-well search for the trouble. These operators have long wanted a cheap, effective way to measure the production of every well every day. Until now, there has been no cheap way to do this effectively and no effective way has been cheap enough.

Shell Oil Co. has what looks like a solution to this problem in its Big Foot field of Frio County, Texas. The company is using an individual-well measuring separator which can be installed for less than $300. This separator measures out exactly ¼ bbl. each time it dumps, and a counter keeps track of the number of dumps. Here are the benefits Shell expects from using these one-well measuring separators:

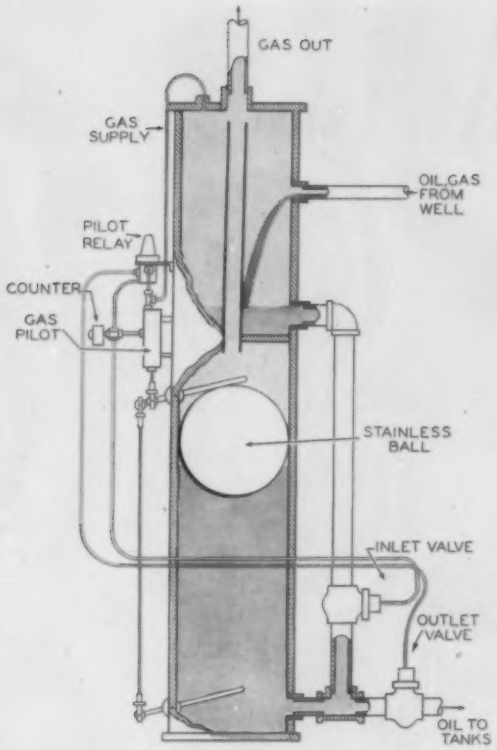
1. Daily well tests.
2. Quick detection of wells off full production.
3. Possible future aid to pumpoff control.
4. Possible future use of remote control or remote indication of well production.

As Fig. 3 shows, the new device uses a free-floating ball which rises and falls in the measuring chamber. Since this ball is very little smaller than the chamber itself, it scrapes the walls clean each time it rises and falls. Thus, the ball should keep paraffin from depositing where it could interfere with measurement.

Since paraffin deposition has in the past been a big objection to dump meters, the free-floating ball might prove a boost for future designs of those devices.

PRODUCING

From low-cost materials . . . Most of the wells at Big Foot have already



POSITIVE VOLUME is provided by floating steel ball which trips pilot levers to open and close inlet and outlet valves. Fig. 3.

On Every Well

reached the stripper stage. For that reason, any production equipment now installed must be cheap or it could never pay out. With this in mind at the beginning, Shell engineers set about designing a measuring device that could be made from common, inexpensive materials.

Latest design of the measuring separator permits building and installing for less than $300—low enough that one can be installed on each well's flow line at the tank battery. With some experimentation, it should be possible to make the device even cheaper.

Piping on the separators is placed so that the vessels may be set in line on 1-ft. centers. Thus, a complete bank of them may be installed, one per well, without changing the dimensions of existing flow-line manifolds. Moreover, all of the individual separators can operate together with only one back-pressure valve.

Accuracy of the dump is within 2 per cent of total fluid produced. Some of the separators have taken up to 75 bbl. of fluid and 200,000 cu. ft. of gas per day with no trouble. Although it has not experimented to find maximum capacity of the vessels, Shell feels these figures are about the greatest that could be handled efficiently.

Uses 10¾-in. line pipe . . . The separator's shell is 10¾-in. line pipe—a common oil-field material that is cheap compared to fabricated pressure vessels. Most piping is 1-in. Besides, the inlet valves are not conventional pressure-operated valves at all—merely inexpensive downstream-pressure regulators. Gas pilots that operate the inlet and outlet valves are relatively cheap and readily obtainable.

As the figures show, the 10¾-in. shell is welded closed at top and bottom. Also, there is a partition welded 2½ ft. from the top to divide the vessel into an upper, or separating, section and a lower, or measuring, section. Total length of the vessel is only 7 ft.

To keep cost down, there is no access to the inside of the vessel other than through the taps made for inlet and outlet lines. Except for the gas outlet which is 2-in., all of these taps are 1-in. diameter. Only moving part inside the separator is the floating ball, and it is made of stainless steel to guarantee long life.

Dumps fast . . . The fluid and gas mixture from the well enters the separator through a 1-in. line connected into the top section. Although there are no baffles in this separator section, there has been no trouble at Big Foot with oil carrying over with the gas. Gravity does separate the mixture—gas rises out the top and the oil collects at the bottom of the upper section.

Except when the measuring section is actually dumping, the valve on the line between top and bottom sections is open. Thus, the oil from the top drains down this external 1-in. line into the bottom section. When oil collects in the bottom section, it floats the stainless-steel ball.

As the bottom section fills, the bell rises until it floats against and moves a mechanical lever. This lever is tied directly to a gas pilot that causes the inlet valve to close and the outlet valve to open. Then, pressure inside the vessel forces the oil out through the outlet line. At Big Foot where the separators operate at 50-psi. back pressure, it takes the oil about 15 seconds to discharge into a 20-psi. treater.

Of course, as oil drains out of the vessel, the floating ball falls with the liquid level. When the oil level drops almost to the bottom, the ball comes against another mechanical lever. This lower lever is tied to the upper one and to the gas pilot. Tripping the lower lever thus causes the outlet valve to close and the inlet valve to open.

Since the ball floats to the same height and falls to the same level at each dump, the separator discharges the same amount of oil each time. Shell has sized the vessel and placed the levers so that the dump is exactly ¼ bbl. There is a counter on the gas pilot that registers each time there is a dump. Therefore, this counter tells exactly how much oil is metered out.

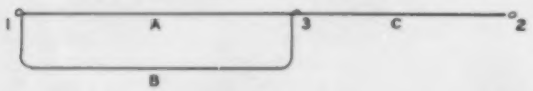
For its first installation at Big Foot, Shell tied the gas-discharge line from the little separators into the inlet to the big production separator. This precaution made certain that no oil would be lost if there were any malfunction, it would not be necessary, however, for permanent installations. **End.**

How to Design Loop Systems

by Dr. John M. Campbell

THE need often arises for increasing the flow rate per unit pressure drop in a system. This is normally encountered where it is desired to increase the capacity or where the flow rate is to remain the same with a lower pressure. The former is a common need in expanding systems while the latter usually stems from older systems wherein the pipe or pumping equipment has to be derated for pressure.

The usual and most economical solution to the problem is to place one or more lines parallel to the original, either partially or throughout the entime length. The figure below shows a schematic view of a simple loop system that may be used to illustrate the principles involved.



The loop and the line it parallels are usually equal in length, for all practical purposes, although conditions sometimes dictate a loop of different length. If the lines are of equal length, however,

$$(\Delta P_f/L)_A = (\Delta P_f/L)_B \text{ and}$$

$$(\Delta P/L)_A = (\Delta P/L)_B \qquad (1)$$

since the lines have two points in common and the change in elevation between Points 1 and 3 is the same. The friction drop in the uplooped section plus that in the looped section must also equal the total friction drop.

The total flow must be divided between lines A and B in some ratio so therefore:

$$Q_A + Q_B = Q_C \qquad (2)$$

Equations 1 and 2 outline the simple relationships existing between the lines so it is necessary to apply these together with the basic equations previously discussed. Several approaches to the problem may be taken.

Use of flow equation . . . It has been developed that the friction factor f is related to Reynolds number (Re) by the equation:

$$f = K/Re^n \qquad (3)$$

where K and n are constants that depend on the type of flow, and that:

$$\Delta P_f = \frac{2 f L v^2 \rho}{g D} \qquad (4)$$

If Equation 3 is substituted into Equation 4 the resultant expression may in turn be incorporated into Equation 1 yielding:

$$\frac{L_A v_A^2}{D_A (D_A v_A)^n} = \frac{L_B v_B^2}{D_B (D_B v_B)^n} \qquad (5)$$

after cancellation of like terms, or:

$$v_A/v_B = [L_B/L_A (D_A/D_B)^{1+n}]^{1/2-n} = C \qquad (6)$$

When $L_A = L_B$:

$$v_A/v_B = (D_A/D_B)^{1+n/2-n} = C \qquad (7)$$

The total flow rate Q_C from Equation 2 therefore equals:

$$0.785\ D_A^2 v_A + 0.785\ D_B^2 v_B = Q_C \qquad (8)$$

or

$$0.785\ D_A^2 C v_B + 0.785\ D_B^2 v_B = Q_C \qquad (9)$$

Equation 9 then enables one to calculate the velocity in both looped lines once the ratio of velocities C is obtained from either Equation 6 or 7. For the usual case of turbulent flow, K = 0.04 and n = 0.172 (see Part 28).

Use of chart . . . The same result may be obtained by using the correlation between $D/\mu\,[\frac{1}{2} D g \rho (\Delta P_f/L)]^{1/2}$ and $\rho v/[\frac{1}{2} D g \rho (\Delta P_f/L)]^{1/2}$ presented in Part 30. Any value of ΔP_f may be assumed and the value calculated for the first expression, and placed on the abscissa for each parallel line in the loop system. The corresponding value found on the ordinate enables one to calculate a value of v for each line.

The value of velocity thus found is not the right one unless by mere coincidence the correct value of ΔP_f was assumed (which is unlikely) but the relative values obtained may be used to obtain the percentage of flow through each line:

$$Q_A/Q_C\ (100) = \frac{v_A D_A^2}{v_A D_A^2 + v_B D_B^2}\ (100) \qquad (10)$$

The applicable percentage times the total flow rate then yields the actual flow rate through each line.

After the flow rate in either parallel line has been determined by one of the above methods the relationship between f and Re (Part 28) may be used to find the respective ΔP_f terms needed to solve the problem for:

$$(\Delta P_f/L)_A X_A + (\Delta P_f/L)_C (L - X) = \text{total } \Delta P_f \qquad (11)$$

Example: A water-flood operator has developed his property so that the present 6-in. raw-water line, which is exactly 8 miles long, delivers 15,000 bbl. per day of fresh water under a gravity flow head of 610 ft. of water.

A new development program for adjacent acreage requires that the capacity of the water-treating plant and the line be increased to 28,000 bbl. per day. If 8-in. pipe is available determine how much must be looped into the original line.

Solution:

$$Q = \frac{(28{,}000)\ (5.61)}{(24)\ (3{,}600)}$$

$$= 1.82 \text{ cu. ft./sec.}$$

$$v = \frac{1.82}{0.785\ (0.506)^2} = \frac{1.82}{0.201}$$

$$= 9.05 \text{ ft./sec.}$$

Author is chairman, School of Petroleum Engineering, University of Oklahoma, Norman.

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Physical properties of water:

$\rho = 62.4$ lb./ft.^{3}

$\mu = 1 \times 0.000672$ lb./ft.-sec.

When handling 28,000 bbl./day, ΔP_f/mile, for 6-in. line:

$$Re = \frac{(0.506)\,(9.05)\,(62.4)}{0.000672} = 4.25$$

$\times 10^5$ and $f = 0.0042$

$$\Delta P_f/\text{mile} = \frac{(2)\,(0.0042)\,(5{,}280)\,(62.4)\,(9.05)^2}{(32.2)\,(0.506)}$$

$= 13{,}900$ lb./ft.^{2}/mile

For loop section, assume ΔP_f/1,000 ft. = 10,000 lb./ft.^{2}

For 6-in. pipe solving for capacity:

$$\frac{0.506}{0.000672}\,[(16.1)\,(0.506)\,(62.4)\,(10)]^{1/2} = \frac{(0.506)\,(71.3)}{0.000672} = 53{,}750$$

and from chart: $\rho v/71.3 = 16.4$:

$$v = \frac{(16.4)\,(71.3)}{62.4} = 18.73 \text{ ft./sec.}$$

and $Q = (18.73)\,(0.201)$

$= 3.77$ cu. ft./sec.

For 8-in. pipe, solving for capacity:

$$\frac{(0.673)}{0.000672}\,[(16.1)\,(0.673)\,(62.4)\,(10)]^{1/2} = \frac{(0.673)\,(82.2)}{0.000672} = 82{,}400$$

and from chart: $\rho v/82.2 = 16.9$:

$$v = \frac{(16.9)\,(82.2)}{62.4} = 22.3 \text{ ft./sec.}$$

and $Q = (0.355)\,(27.3)$

$= 7.91$ cu. ft./sec.

$$Q_{6"} = \frac{3.77}{3.77 + 7.91}\,(100)$$

$= 32.3$ per cent

Therefore:

$Q_{8"} = 67.7$ per cent

Applying volume per cent to the daily quantity of water to be handled:

6-in. $= 0.323 \times 28{,}000$

$= 9{,}050$ bbl./day

8-in. $= 0.677 \times 28{,}0000$

$= 18,950$ bbl./day

or, on the basis of 1.82 cu. ft./sec.

$Q_{6"} = 0.323 \times 1.82$

$= 0.588$ cu. ft./sec.

$Q_{8"} = 0.677 \times 1.82$

$= 1.232$ cu. ft./sec.

To find ΔP_f/mile of loop section:

Taking 6-in. line:

$$v = \frac{0.588}{0.785\,(0.506)^2} = \frac{0.588}{0.201}$$

$= 2.925$ ft./sec.

$$Re = \frac{(0.506)\,(2.94)\,(62.4)}{0.000672} = 1.38$$

$\times 10^5$ and $f = 0.005$

$$\Delta P_f = \frac{(2)\,(0.005)\,(5{,}280)\,(62.4)\,(2.94)^2}{(32.2)\,(0.506)}$$

$= 1{,}730$ lb./ft.^{2}

Checking, take 8-in. line:

$$v = \frac{1.229}{0.785\,(0.673)^2} = \frac{1.229}{0.355}$$

$= 3.47$ ft./sec.

$$Re = \frac{(0.673)\,(3.47)\,(62.4)}{0.000672} = 2.17$$

$\times 10^5$ and $f = 0.0047$

$$\Delta P_f = \frac{(2)\,(0.0047)\,(5{,}280)\,(62.4)\,(3.47)^2}{(32.2)\,(0.673)}$$

$= 1{,}720$ lb./ft.^{2}

The available ΔP_f on the line:

$(610)\,(62.4) = 38{,}000$ lb./ft.^{2}

So, if X = miles of loop and $(8 - X)$ = miles of unlooped 6-in.:

$(X)\,(1{,}730) + (8 - X)\,(13{,}900)$

$= 38{,}000$

$1{,}730\,X + 111{,}000 - 13{,}900\,X$

$= 38{,}000$

$12{,}160\,X = 73{,}000$

X = 6.0 miles of loop line.

The above basic procedure may be used for a loop system containing any number of parallel lines. It may also be shown that the position of the loop along the line makes no difference in the total capacity. **End.**

BOOKS

THE BLACK BONANZA by Earl M. Welty and Frank J. Taylor. Published by McGraw-Hill Book Co., Inc., 330 West Forty-second Street, New York 36. 243 pp.

The true story of the founding of Union Oil Co. by Lyman Stewart and Wallace Hardison is told in this new book. Its growth from the early days in the muddy, brawling Pennsylvania oil rush to the pipelined petroleum business of the present is presented.

Most of the early scenes are laid in southern California where Union's forebears were drilling hopefully for oil while others looked for gold. However the history of the Union Oil is unique since the company's roots were deep in Pennsylvania's original oil boom as well as California's. The authors give the exciting history of the growth of Union Oil and the oil industry.

ADVANCES IN CHEMICAL ENGINEERING, Vol. 1, Thomas B. Drew and J. W. Hoopes, Jr., editors. Published by Academic Press, Inc., 11 Fifth Avenue, New York, N. Y., 448 pp., $10.00.

The purpose of this series is to provide the engineer with critical running summaries of recent work: some that bring standard topics up to date; others that gather and examine the results of new or newly utilized techniques and methods. The reports included in this first volume are not merely annotated bibliographies but are definitive and critical analyses by authors qualified in their field.

An idea of the subjects covered may be obtained from the chapter headings: Boiling of Liquids; Non-Newtonian Technology—Fluid Mechanics, Mixing and Heat Transfer; Theory of Diffusion; Turbulence in Thermal and Material Transport; Mechanically Aided Liquid Extraction; The Automatic Computer in Control and Planning of Manufacturing Operations; Ionizing Radiation Applied to Chemical Processes and to Food and Drug Processing.

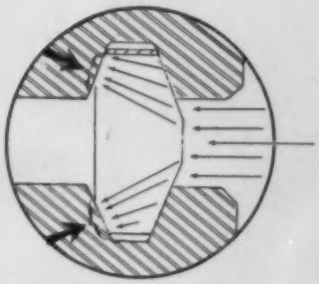
MAP

TECTONIC MAP OF OKLAHOMA, compiled by J. Casper Arbenz. Published by Oklahoma Geological Survey, University of Oklahoma, Norman, Okla.

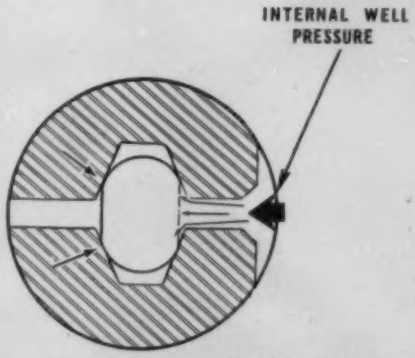
The Oklahoma Geological Survey announces the publication of the tectonic map of Oklahoma. This map shows the surface structural features and the principal structural elements of the state. Scale of the map is 1 in. equals 12 miles. The map is in color and is 12 by 30 in.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

INTERNAL PRESSURES assist sealing effect of new self-sealing ring gasket.



CONTACT AREAS with the flange groove are increased tremendously with the self-sealing gasket.



OLD-STYLE GASKET has small curved contact areas. Continuous retightening is necessary.

Self-Sealing Ring Gasket Solves Many Problems

A NEW self-sealing ring gasket for A.P.I. flanged connections eliminates most of the headaches and hazards so prevalent with the old-style oval or octagonal A.P.I. gaskets. This new gasket, a development of Cameron Iron Works, Inc., is being released to the industry royalty-free.

The Cameron design development group, while working with flanges for extreme high pressures, noticed a self-sealing effect in special rings being used in tests on flanged connections. Rings were altered to increase the self-sealing effect and to combat gasket failures from drilling vibrations, test-load shocks, etc.

The result is a gasket which uses internal pressures to assist sealing effect, requires far less makeup time, no retightening, and offers a degree of safety not possible with present A.P.I. gaskets.

How it seals . . . In section, the new gasket is taller than the conventional A.P.I. oval gasket and has large flats which mate with the standard groove preparations. As flanges are made up, the flats on the outside diameter of the self-sealing ring gasket make contact with the groove first. This causes the self-sealing gasket to be preloaded against the groove's outer surfaces as the flanges are brought together.

This preloading is stopped when the ring's inner surfaces come into contact with the inner surfaces of the groove. This insures proper alignment and stopping, and offers maximum resistance to external forces. The ratio of ring height to the width of the bearing of the ring's outer surfaces in the groove has been increased so that a self-sealing condition exists.

It has been found that the ratio of ring height to bearing width must be 3 to 1 or greater for a self-sealing effect. Only standard A.P.I. stud lengths are necessary with the increased height of the new self-sealing ring gasket. Ring-groove condition is not critical.

Standard A.P.I. gaskets . . . Stud bolts used with standard A.P.I. oval or octagonal ring gaskets must perform the double duty of holding pressure while keeping the gasket compressed. When making up a joint, the curved surface of the relatively soft oval-ring gasket is mated with the flat surfaces of the hard flange groove. A small flat is pressed on the curved section of the oval ring. The size of this flat depends on the bolting makeup tightness.

As normal tightening proceeds, forces accumulate and deform the ring to produce a seal. By the time all bolts around the flange have been tightened, the first bolt is loose again. In most A.P.I. flanged connections, it is necessary to tighten bolts around the flange several times to reach a stable condition. On larger flanges this may take over an hour of expensive rig time.

When internal-pressure forces become great enough to cause flexing in an A.P.I. joint using an oval or octagonal gasket, the bolting contact force on the seal ring begins to decrease. If flange separation exceeds the limited resilience of the seal, leakage will occur. External shock loads such as drilling vibration add to the compressive loading of the stud bolts to further deform the A.P.I. gaskets, cause leaks, and make repeated tightening necessary.

The two basic faults of both oval and octagonal A.P.I. seal-ring designs is that they cannot withstand external loads properly and that internal pressure does not assist their sealing ability.

Self-sealing gasket . . . The self-sealing ring gasket solves these difficulties. Stud bolts need to be tightened only once around to preload the gasket and start the self-sealing effect. Vibration during drilling operations which normally puts destructive stress on A.P.I. rings in drilling-control hookups does not affect bolt tension or gasket seal.

Rough handling of christmas trees in shipment or extreme test-pressure shocks do not necessitate retightening of stud bolts. This, of course, means a big saving in time and effort. It also means safer working conditions—especially important offshore.

Numerous tests under many conditions have been made to determine the efficiency of these pressure-energized gaskets. In each case they formed a safer seal with only a fraction of the bolt tightness required by the conventional oval gasket. For example, one gasket made up in a 2-in. A.P.I. 5,000-psi. flange with a bolt tightness of 220 ft.-lb. held pressures up to 30,000 psi. without leakage.

This new type of self-sealing ring gasket saves hours of nippleup time and insures a tight connection under most adverse circumstances, which in turn will save time and money.

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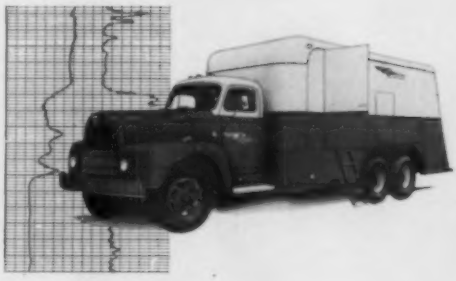

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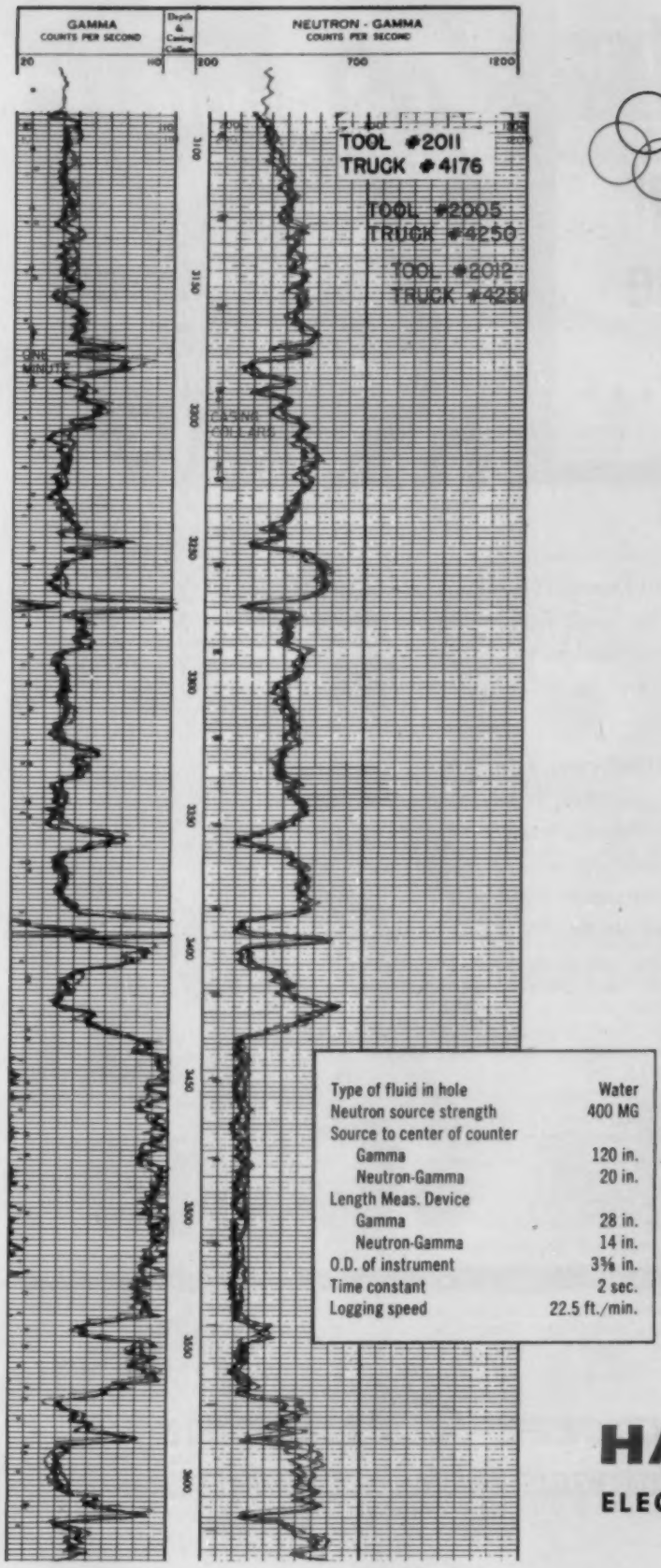

Type of fluid in hole	Water
Neutron source strength	400 MG
Source to center of counter	
Gamma	120 in.
Neutron-Gamma	20 in.
Length Meas. Device	
Gamma	28 in.
Neutron-Gamma	14 in.
O.D. of instrument	3⅜ in.
Time constant	2 sec.
Logging speed	22.5 ft./min.

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Shown in red, blue and black are the original galvanometer records for three radiation surveys. They were made in one well by three Halliburton logging units as a test of repeatability.

They were made with three Geiger counters. Three formation-to-surface transmission systems. And three neutron sources. Three operators performed the careful calibration procedures that statistical variation demands.

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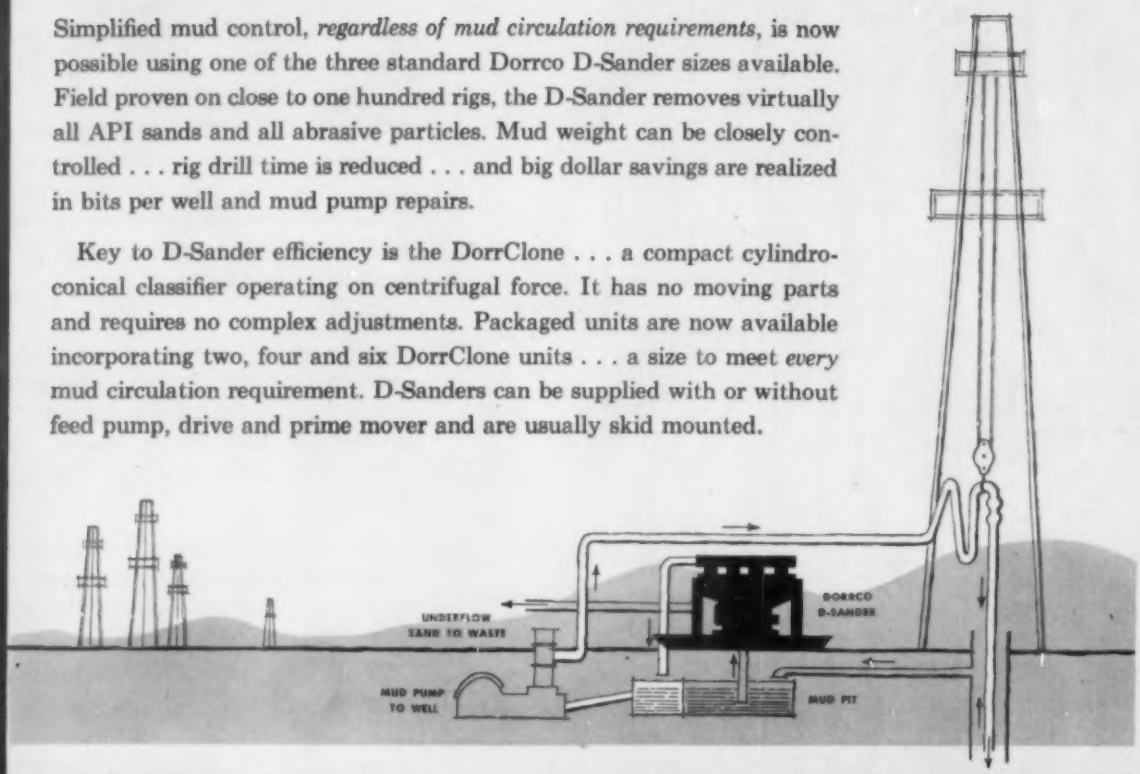
Key to D-Sander efficiency is the DorrClone . . . a compact cylindro-conical classifier operating on centrifugal force. It has no moving parts and requires no complex adjustments. Packaged units are now available incorporating two, four and six DorrClone units . . . a size to meet *every* mud circulation requirement. D-Sanders can be supplied with or without feed pump, drive and prime mover and are usually skid mounted.



For more information on the Dorrco D-Sander, contact our U. S. Sales Representative, Salt Water Control Inc., 1211 Fort Worth National Bank Building, Fort Worth 2, Texas.

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JOB IMPROVEMENT FOR THE PROCESS FOREMAN—84

Are You Wasting Process-Fuel Gas?

HEATING the oil is the first step in almost every stage of processing. This seems fairly elementary and not worthy of too much consideration, but the fuel gas consumed daily in this refinery for processing and power amounts to about 125,000,000 cu. ft. That is, 45,625,000,000 cu. ft. a year.

Anyone that has paid a gas bill lately will realize that here is truly a fertile field in which to practice economy. This can be best accomplished by an understanding of the principles of combustion, furnace operation and furnace construction.

...**Combustion** is the reaction from chemically combining a fuel with oxygen at high speed and high temperature. The gas used in refinery furnaces is mostly methane and ethane (dry gas) and the oxygen that supports combustion is taken from air.

Combustion can be inefficient and dangerous or efficient and safe, depending upon how well it is regulated. Proper combustion in furnaces is essential for these reasons:

1. Safer. Tubes are not as likely to burn out and cause fires and there is less chance of a blast of hot air shooting out when a furnace peephole door is opened.

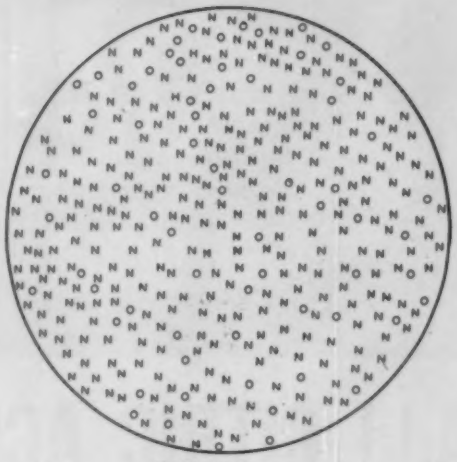
2. Makes operation easier. Steadier heat holds the transfer-line temperature smoother, lessening the times the amount of gas to the furnace must be changed.

3. Saves fuel gas. Good combustion causes the most heat to enter the furnace charge stock for the amount of gas burned.

4. Reduces maintenance costs. Less oxidation and scaling on the outside and coking on the inside of furnace tubes is a mark of proper furnace operation.

5. Increases production throughput on units limited by furnace capacity. More barrels of charge can be heated to transfer-line temperature within the limitations of the equipment if proper combustion is obtained.

This material is taken from "Fundamentals of Refining," operating manual of Magnolia Petroleum Co., refining division, Beaumont, Tex.



TEN CUBIC FEET of air is the theoretical amount required to burn 1 cu. ft. of natural gas. Fig. 9.

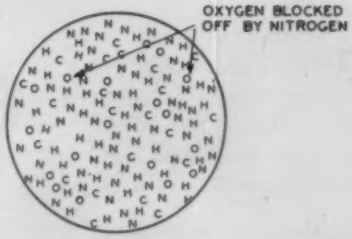
A better understanding of combustion is possible if the words commonly associated with it are explained in that light:

1. Energy is the ability to do work.

2. Heat is one form of energy.

3. B.t.u. is a unit used in the measurement of heat. The abbreviation means British thermal unit. That is the amount of heat which will raise the temperature of 1 lb. of water 1° F. One B.t.u. of heat contains enough energy to raise a 778-lb. weight 1 ft. One cubic foot of natural gas makes about 1,000 B.t.u. when burned. If completely utilized, 1 cu. ft. of gas could raise a 778-lb. weight 1,000 ft.

4. Temperature is a measure of the intensity of heat. Its units are degrees Fahrenheit or centigrade. The Fahrenheit scale is used almost exclusively in the refinery. For an example of the difference between temperature and heat, compare a cup of coffee to a unit water box. The coffee may be scalding hot, but there is not much of it. The water in the box may be lukewarm to touch, but its quantity is so large it holds much more heat than the cup of coffee. The coffee has the higher temperature, but the waterbox has more B.t.u.'s of heat.



MIXTURE of natural gas and air for burning. Fig. 10.

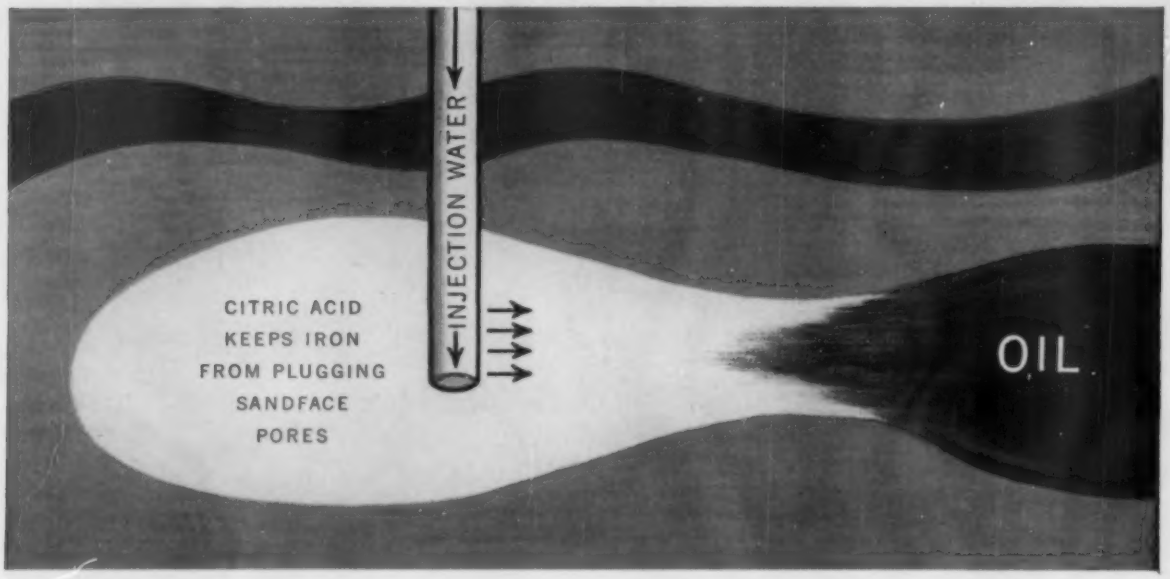
Fuel gas is carbon and hydrogen, each of which burns with oxygen. Chemists picture the separate reactions of combustion or burning in the following manner:

Carbon burning:
$C + O_2 = CO_2 + \text{heat}$
carbon + oxygen
= carbon dioxide + heat

Hydrogen burning:
$H_2 + \frac{1}{2}O_2 = H_2O + \text{heat}$
hydrogen + oxygen
= water vapor + heat

Natural gas burning:
$CH_4 + 2O_2$
$= CO_2 + 2H_2O + \text{heat}$
natural gas + oxygen
= carbon dioxide
+ water vapor + heat

Improve flow rates in secondary recovery



Add CITRIC ACID to injection water

● When you add citric acid to injection water you prevent the formation of iron precipitates which plug the sandface, restricting the flow rate. This means that you reduce the need for temporary (and sometimes costly) methods of freeing iron-plugged wells.

Also important, citric works even in high calcium waters. Citric preferentially sequesters the iron and keeps it soluble. Other ions do not interfere.

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by Dave Vondy
Constructive Engineering Co.

SPHERICAL PROCESS VESSELS—8

Baffle Design Affects Vessel Capacity

ALSO using common terminology, the separating capacity can be expressed as:

$$M = C[\rho_g (\rho_L - \rho_g)]^{1/2}$$

$$V = K[(\rho_L - \rho_g)/\rho_g]^{1/2}$$

$$Q = VA, \text{ where } A = \pi D_s^2/4\,(144)$$

$$Q_a = 471\, D_s^2\, V$$

$$Q_s = 6{,}170\, D_s^2\, V\, \rho_g/W_s$$

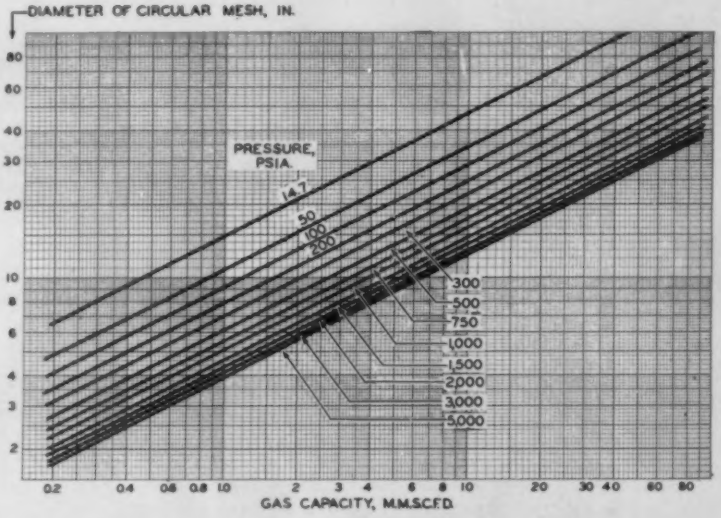
$$Q_s = 1.174\, D_s^2\, M/W_s$$

Definition of symbols

- C = Brown-Souders mass velocity constant
- K = allowable velocity constant
- D_e = effective diameter of sphere, in.
- D_s = psuedodiameter of sphere, in.
- D = sphere diameter, in.
- ρ_g = gas density, lb. per cu. ft.
- ρ_L = liquid density, lb. per cu. ft.
- P = pressure, psia.
- T = temperature,, °Rankine, or °F. plus 460
- Z = supercompressibility factor.
- M = allowable mass velocity, lb./sq. ft.
- V = allowable velocity, ft./sec.
- Q = allowable capacity
- Q_a = allowable cap., M.M.c.f.d. actual
- Q_s = allowable cap., M.M.s.c.f.d.
- A = cross-sectional area, sq. ft.

The results of this analysis and calculation are presented in the table and Fig. 5 *(The Oil and Gas Journal, March 11)*. The psuedodiameters and Fig. 5 can be applied in general if the various factors involved are considered carefully. The results give the size of a vessel required for the separation of liquid from gas as determined by good process design. If the vessel is to have no mist extractor, a small carryover will be realized and a larger vessel may be practical; if the vessel is to have a suitable mist extractor and will not be expected to handle excessive peak loads, a smaller vessel may be suitable.

EFFECT of design on carryover. Fig. 6.



CAPACITY of wire-mesh mist extractors for general application. Fig. 7.

Fig. 6 illustrates the effect of design on carryover. In any separating vessel, the design of deflecting baffles and quieting plates influence the capacity. Often field tests indicate that up to a certain rate the vessel will separate satisfactorily but above that rate improper operation results.

Actually from any design, below a certain capacity, no or little carryover will be realized and as the flow rate is increased the carryover from the primary separating zone or the liquid feed to the mist ex-

(Continued on next page)

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tractor increases. At some high rate the mist extractor becomes overloaded. An exception is that case where a foaming condition causes a buildup in the vessel and thereby reduces the capacity to some low value.

Concentrated volume . . . A spherical vessel has a concentrated volume. This results in reduced separating height above the inlet and a liquid level close to the primary separating zone. Most effective design is that which prevents reentrainment of liquid from the bottom of the vessel, which reduces the high velocity of the inlet stream at the entrance to the vessel and which distributes the gas inside the vessel; a maximum of the central volume of the vessel must be used for primary separation.

The use of prototype testing to check design is of unequaled value in establishing most effective design. Plastic vessels can be used to permit observation of the actual operation.

Fig. 7 illustrates the capacity of wire-mesh mist extractors for general application. The plot is of the equation:

$$Q_s = 1.714\ D^2\ M/W_s$$

where $M = 1{,}250\ [\rho_g\ (\rho_L - \rho_g)]^{1/2}$

using a C value of 1,250 for the mesh. Conditions and symbols are used as before, 0.65 sp. gr. gas and liquid and 80° F. operation.

Thus where a vessel for separation to handle 50 M.M.s.c.f.d. gas at 1,000 psi. would need to be in the neighborhood of 70 in. in diameter. A vessel for the purpose of removing a small amount of carryover liquid from 50 M.M.s.c.f.d. gas at 1,000 psi. need be only large enough to contain a 36-in. mist-extractor element, or probably about 40 in. in diameter. **End.**

SPHERICAL PROCESS VESSELS

by Dave Vondy

Part 1—October 15, 1956, p. 148.

Part 2—November 12, 1956, p. 213.

Part 3—December 3, 1956, p. 135.

Part 4—January 7, 1957, p. 130.

Part 5—February 4, 1957, p. 136.

Part 6—February 11, 1957, p. 130.

Part 7—March 11, 1957, p. 189.

by Dr. J. M. Ryan
The Datics Corp.

Using Electronic Computers in the Oil Industry **Part 7**

How to Determine Density Values

A PREVIOUS issue of PETROdatics (No. 6) described the computation of compressibility factors at equal intervals of density and temperature from the Benedict equation of state. A more common problem is to compute compressibilities at equal increments of pressure and temperature. This procedure involves finding a value of density which gives the desired pressure and then using these values of pressure and density along with the temperature to compute the deviation factor. The problem of determining what value of density yields the desired pressure is discussed here.

The Benedict equation of state

$$P = RTd + (B_oRT - A_o - C_o/T^2)\,d^2 + (bRT - a)\,d^3 + a\alpha\,d^6 + c\,d^3\,(1 + \gamma\,d^2)\,e^{-x} \quad (1)$$

where $x = \gamma\,d^2/T^2$.

cannot readily be solved for d in terms of P. Hence, a system of trial and error must be devised.

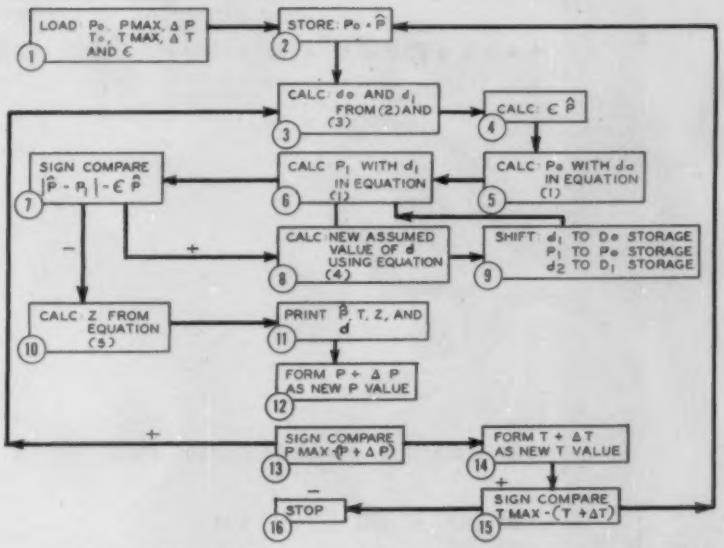
There are many iterative methods of solving equations such as (1). The one proposed here is not necessarily the best, but it is quite convenient on electronic computers.

Assume that the density, **d**, corresponding to the given pressure, **P**, is desired. Two initial guesses at d are made. For example:

$$d_o = P/RT \quad (2)$$

$$d_1 = P/0.8\,RT \quad (3)$$

If better information about the system is available, improved guesses should be used. Each assumed value is inserted in the Benedict equation


LOAD Po, PMAX, Δ P To, T MAX, Δ T AND ∈
STORE: Po = P̂
CALC do AND d1 FROM (2) AND (3)
CALC: ∈ P̂
SIGN COMPARE |P̂ - P1| - ∈ P̂
CALC P1 WITH d1 IN EQUATION (1)
CALC Po WITH do IN EQUATION (1)
CALC NEW ASSUMED VALUE OF d USING EQUATION (4)
SHIFT: d1 TO Do STORAGE P1 TO Po STORAGE d2 TO D1 STORAGE
CALC Z FROM EQUATION (5)
PRINT P̂, T, Z, AND d
FORM P + Δ P AS NEW P VALUE
SIGN COMPARE P MAX - (P + Δ P)
FORM T + Δ T AS NEW T VALUE
SIGN COMPARE T MAX - (T + Δ T)
STOP
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

IN THIS BLOCK DIAGRAM it is assumed that Z is to be computed at equal increments of pressure between P_o and T_{max}.

which is solved in turn for P_o and P_1. The values of d_o, d_1, P_o, and P_1 are now used to obtain an improved guess at **d**. This new value, d_2, is obtained by solving the expression:

$$\frac{d_2 - d_o}{P - P_o} = \frac{d_1 - d_o}{P_1 - P_o} \quad (4)$$

for d_2. This results in:

$$d_2 = \frac{(d_1 - d_o)\,(P - P_o)}{(P_1 - P_o)} + d_o$$

The value of d_2 so obtained is substituted into Equation 1 to obtain P_2. If P_2 is sufficiently close to **P** the values of **P**, T and d are used to find Z. If P_2 does not equal **P** within the specified tolerance, the process is repeated. The machine is instructed, prior to the next trial, to exchange d_1 for d_o, d_2 for d_1, P_1 for P_o and P_2 for P_1.

Experience indicates that usually not more than two additional iterations are necessary to obtain satisfactory values for **d**.

Once a satisfactory value for **d** is obtained the formula used to obtain Z is given in Equation 5.

$$Z = \frac{P}{NRTd} \quad (5)$$

In the block diagram shown, it is assumed that Z is to be computed at equal increments of pressure between P_o and P_{max} and at equal increments of temperature between T_o and T_{max}. A computed value of P within ϵ per cent of P is assumed to be adequate.

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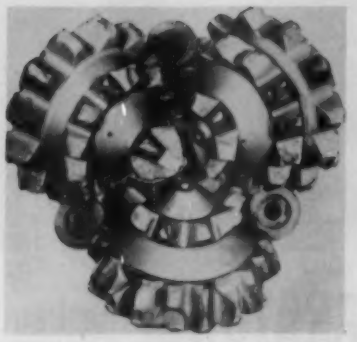
ROCK-BIT DESIGN, SELECTION, AND EVALUATION

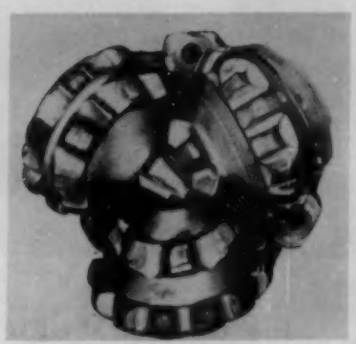
Tooth Wear Shows How Bits Dull

by H. G. Bentson
H. C. Smith Oil Tool Co.



SELF-SHARPENED teeth. Fig. 37.

EVEN tooth wear. Fig. 38.



EXAMPLE of undergage. Fig. 39.

IN contrast to the previous illustrations showing various undesirable tooth conditions, Fig. 37 and Fig. 38 illustrate desirable characteristics. The condition of the teeth on the dull bit shown in Fig. 37 is indicative of the desirable self-sharpening effect previously discussed. Here, the facing on the side of the teeth has resisted wear and permitted the opposing side to wear away. The sharp crests maintained thereby should result in a slower decline in the penetration rate as the teeth become worn.

The bit shown in Fig. 38 exemplifies one which usually would be considered a good dull. It will be noted that tooth wear is balanced and not excessive, and that there are no broken, cupped, bradded, or fluid-cut teeth.

Undergage and skidding . . . An excessively undergage bit is shown in Fig. 39. The cause of this condition may be attributed to the use of a bit type having insufficient gage protection. If this is the reason, a bit type which incorporates greater gage protection should be used. Excessive wear on the gage, however, is also possible as the result of prolonged rotating time.

A bit which has skidded due to balling is shown in Fig. 40. Excessive bit weight may be a cause of this condition. In soft formation excessive weights will result in the bit floundering due to excessive penetration. When this occurs the cones are restrained from rotating and further rotation of the bit wears off those teeth which protrude downwardly. By reducing the bit weight this floundering would not occur and the balling tendency should be decreased.

The use of an improper bit type may also cause balling and skidding due to inadequate tooth spacing and subsequent formation packing between the teeth. Inefficient removal of the formation cuttings from the bottom of the hole as a result of an insufficient fluid circulation rate is frequently the reason for balling. It should be apparent that an increased fluid circulation rate is required when this condition occurs.

BALLING has caused skidding. Fig. 40.

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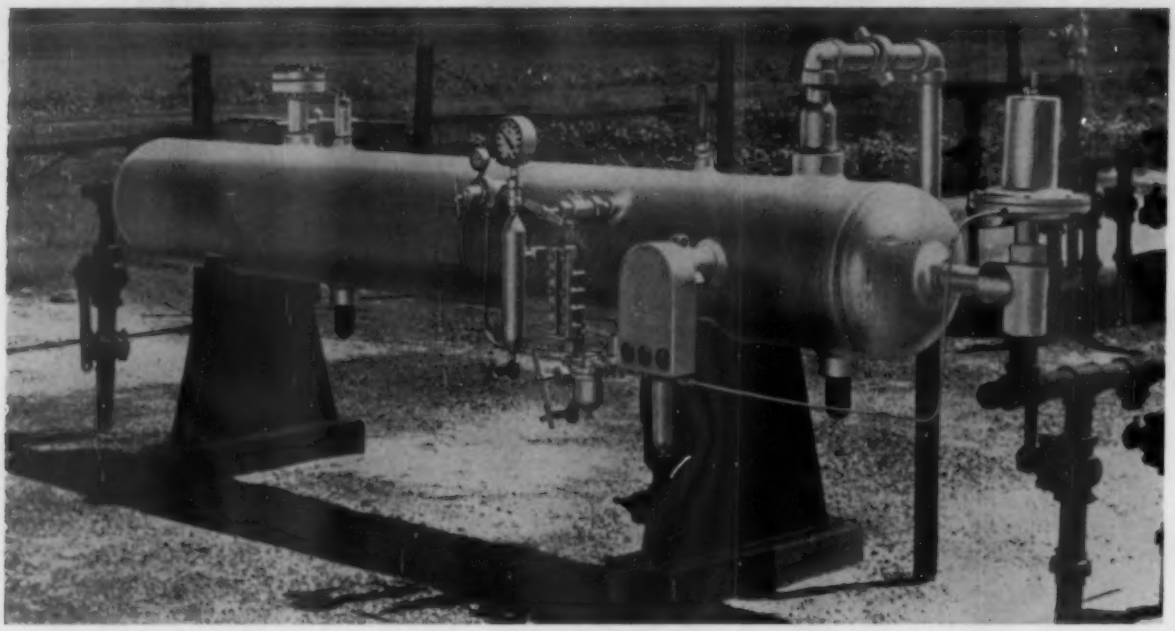

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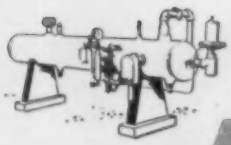

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by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

How Much Fuel Do Refineries Use?

What is the average amount of fuel used by refineries? I was told it amounts to 10 per cent of the crude oil.—R.S.G.

The U. S. Bureau of Mines publishes each year the average fuel consumption and also the amount of purchased electricity. The amount of fuel has ranged from as low as 555,000 B.t.u. per barrel of crude oil in 1939 to as high as about 700,000 B.t.u. in 1956. If crude oil has a heating value of 6,000,000 B.t.u. per barrel, the above figures indicate the equivalent of 9.2 to 11.7 per cent of the crude oil. Note that these heat requirements include the burning of coke from catalyst as well as the more common fuels such as refinery gas, natural gas, residual fuel oil or pitch and such fuels as acid sludge and a small amount of coal. The percentages of these various fuels used during 1955 were about:

	Per cent
Oil fuel	13.7
Coal	1.2
Natural gas	37.4
Refinery gas	43.0
Coke (catalyst)	4.2
Acid sludge	0.5

The fuel is used in four major ways: (1) for sensible heat and latent heat in direct-fired heaters, (2) in generating steam (and electricity), (3) for power as a fuel for gas or diesel engines, and (4) for heating catalyst or solid material in the catalytic cracking processes. Thermal efficiencies in various services (based on gross heating value) are about:

	Per cent
Direct-fired heaters	60-70
Steam generation	65-75
Coke from catalyst	*50-60

*Low mainly because of incomplete combustions.

Thus, probably not more than 65 per cent of the heat or about 4½ million B.t.u. actually enters the barrel of oil, the remaining heat going up the stack or remaining as chemical energy in carbon monoxide (in regenerator flue gas).

Most of the fuel can be priced at the fuel-oil equivalent of Bunker C fuel, i.e., refinery gas, catalyst coke, residual pitch, and acid sludge, but the natural gas used throughout much of the Southwest is much cheaper. This leads to an average fuel cost of about 27 cents per million B.t.u. during 1955, or a cost of about 17 cents per barrel of crude oil.

Characterization Factor of Coker Gas Oils

Coker gas oil is a poor charge stock for catalytic cracking. Is this related to its low characterization factor?—S.Wm.T.

Although coker gas oils have lower characterization factors than their parent feed stocks, this alone does not account for their poor behavior upon catalytic cracking. Apparently the presence of unsaturated materials and a larger amount of aromatic rings, as well as the possibility of entrained material which contributes to a higher carbon-residue test and extra coke during cracking, also contribute to its inferiority during catalytic cracking.

Fig. 1 indicates that coker gas oils have characterization factors that are normally only 0.1-0.2 units lower than characterization factors of the parent feed stock. However, under the most severe conditions of coking, the factors may be lower by 0.4-0.5 units. Scant data (only two points) indicate that visbroken tars produce coker gas oils similar (with respect to characterization factor) to those from straightrun coker feeds.

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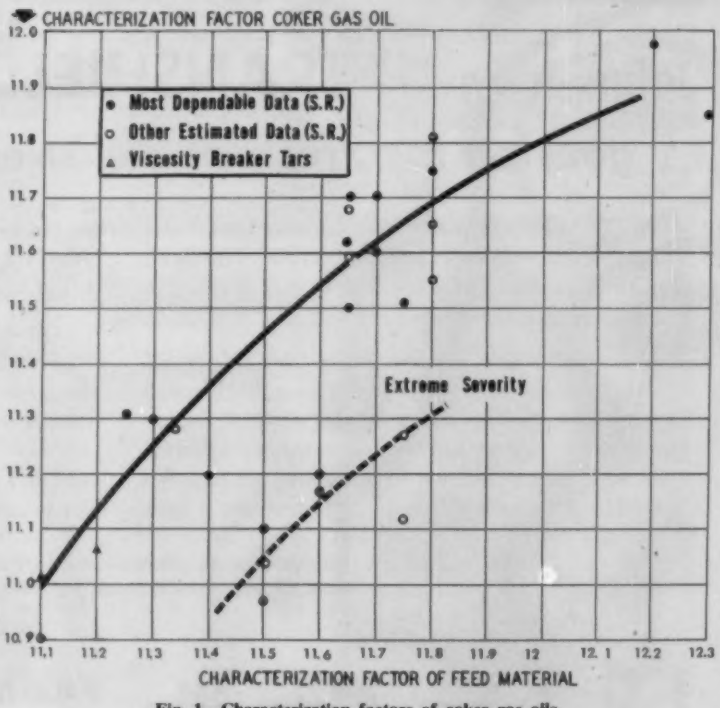
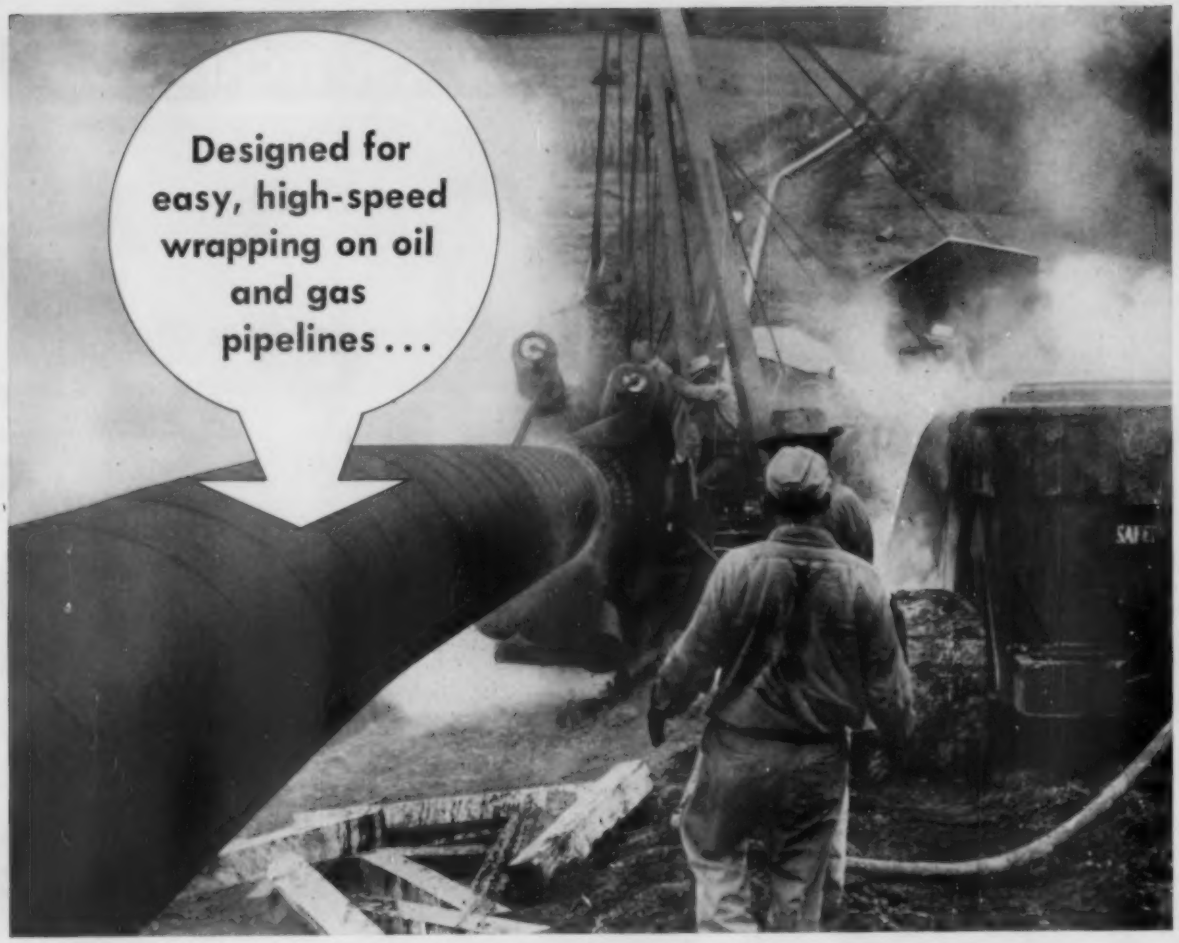


Fig. 1—Characterization factors of coker gas oils.



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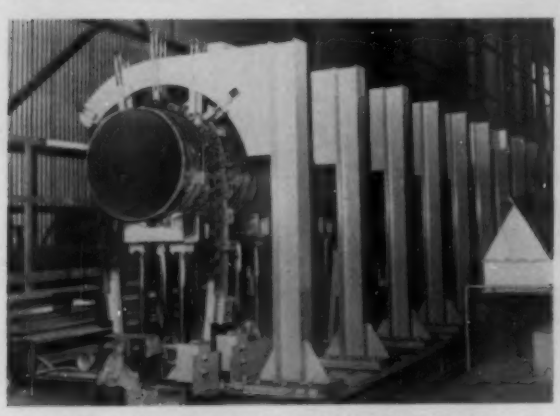
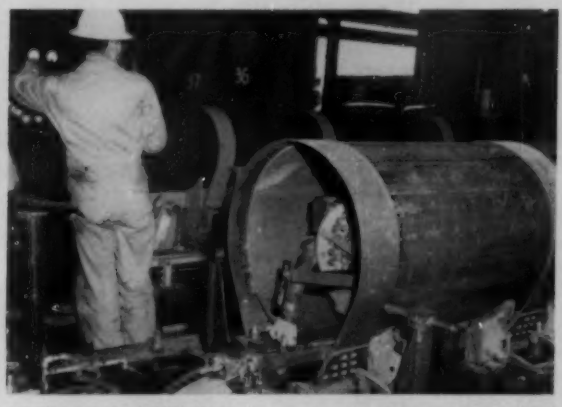


TACK-WELDING JIG for submerged arc-welded line pipe. The pipe is placed in this jig and manually tack welded. Fig. 1.



AFTER TACK WELDING the can is i.d. submerged arc welded with tandem electrodes. Note the starting tab and clamps. Fig. 2.

From steel plate to pipelines . . .

Welding processes described

IN the manufacture of submerged arc-welded line pipe,[1] it is customary after the forming operations to weld the o.d. and then the i.d. of the pipe. In the new submerged arc-weld pipe mill at Consolidated Western Steel Division's Geneva Works, a new procedure is employed in which the pipe after forming is tack welded in the jig shown in Fig. 1. After tack welding the i.d. weld is applied as shown in Fig. 2. This is followed with the o.d. weld as shown in Fig. 3. After o.d. welding, the pipe is expanded in the usual manner. This modified practice for manufacturing submerged arc-welded line pipe eliminates the necessity of special end welds with a minimum amount of tack welding and the use of tandem electrodes.

Controlling weld quality . . . In the manufacture of submerged arc-welded line pipe, radiography may be used as a control of weld quality. Although A.P.I. line-pipe specifications do not provide for radiography, it is used as a process-control procedure and is the most reliable test available for this specific purpose. An arrangement for X-ray examination of line pipe is shown in Fig. 4. Standards and procedures for process control of weld quality have been described.[2]

The X-ray standards for process control in the manufacture of double submerged arc-welded line pipe are summarized in Table 1. The radiographic charts based upon the limitations shown in Table 1 are illustrated in Figs. 5 and 6. The maximum distribution of individual slag inclusions and/or gas pocket in any location is shown in Fig. 5.

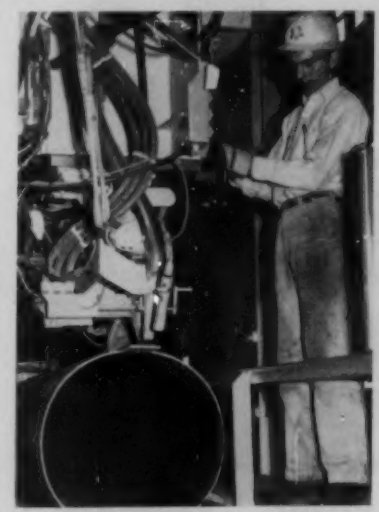
The maximum distribution of aligned gas pockets in any location is shown in Fig. 6.

These standards are based upon 175 transverse-weld tensile tests with discontinuities and a large number of transverse-weld tensile tests consisting of sound weld metal which were adjacent to the tests with discontinuities. In addition, many transverse tensile tests were made of the pipe material without any weld.

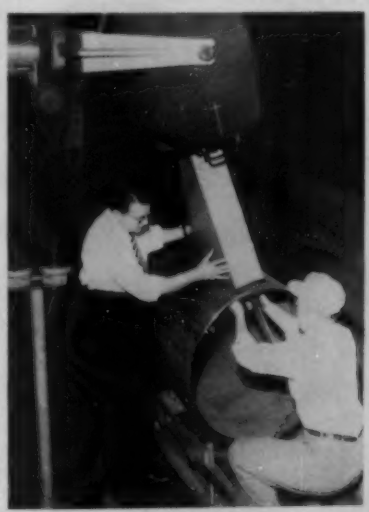
The standards for discontinuities in Figs. 5 and 6 are not exactly similar to A.P.I. Standard 1104 for field girth welding. This is because the standards are particularly adapted to automatic double submerged arc-welding with the plate edges to be welded adjacent to each other.

This is an entirely different welding practice and superior to the manual metallic-arc all-position welding of a V-groove with three or more passes without the use of a backup strip which is employed in the girth welding of the line pipe.

New X-ray method . . . Recently, a new method for the continuous X-ray examination (of line pipe) has been developed. This method does not re-



AFTER I.D. WELDING the can is o.d. submerged arc welded with tandem electrodes. Fig. 3.



X-RAY examination of the longitudinal weld of submerged arc-welded line pipe. Fig. 4.

Material from paper by A. B. Wilder, chief metallurgist, National Tube Division, U. S. Steel Corp., presented at annual A.S.C.E. meeting, Pittsburgh, October 16, 1956.

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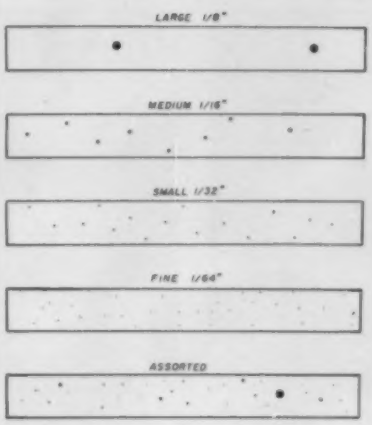
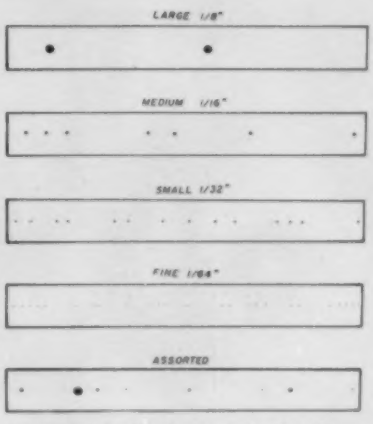


MAXIMUM distribution of individual slag inclusion and/or gas pockets in any location. Fig. 5.



MAXIMUM distribution of aligned gas pocket in any location. Fig. 6.

quire the use of a film, but is in the experimental stage and will be described at a later date.

The method has possibilities of providing an X-ray technique at a lower cost for examination of not only the longitudinal weld, but also the field girth weld. Elimination of the use of a film and the direct visual examination of steel for internal weld defects is indeed a new approach in this country to control of weld quality in the manufacture of line pipe.

Special Welding Processes

In addition to submerged arc-welding process, there are electrical-resistance and flash-welding processes used for the manufacture of line pipe. There are also other methods for the automatic welding of pipe in the experimental stage which include the use of inert atmospheres of argon, helium, or carbon dioxide. A bare electrode of suitable composition is employed.

In girth welding with inert gas, welding in the overhead position has been responsible for undue porosity. Use of the automatic submerged arc-welding process with granular flux is not practical in the field for welding the entire pipeline due to the necessity for rotating the pipe to maintain a flux blanket. This process, however, has been used successfully for welding several joints of pipe under field conditions by rotation of the pipe during welding.

A new welding method known as the I^2RT^3 welding process provides for single-electrode metallic arc-welding at welding speeds otherwise attainable only with tandem electrodes. This method of welding in the future may be adaptable to both inert gas and submerged arc-welding processes. It has been experimentally used in the production of submerged arc-welded line pipe.

Pressure welding . . . The application of pressure welding to the manufacture and also the joining of large-diameter pipe in the field has been used but is not practical at the present time. The process is successfully used in the manufacture of small-diameter pipe and both longitudinal and girth welds are produced by this method using gas or induction heating.

A number of years ago in field welding large-diameter pipe (26-in. o.d.), the ends were heated with a gas flame and at a welding temperature the joint was upset. No welding wire was employed and the operation required only a few minutes. The problem was to consistently produce a good weld and this depended in a large measure upon the temperature of the joint at the time of pressure welding.

In the future it may be practical to successfully pressure weld large-diameter pipe. When this is accomplished, the cost of pipeline construction may be appreciably reduced.

In flash welding and electric-resistance welding, the surface to be welded is uniformly heated to the fusion temperature due to the electric resistance of the joint. In pressure welding, it is necessary to achieve a similar result with gas or induction heating.

TABLE 1—RADIOGRAPHIC STANDARDS FOR PROCESS CONTROL OF WELD QUALITY

1. The radiographic technique shall be such as to determine quantitatively the size of defects with thickness equal to or greater than 2 per cent of the wall thickness.

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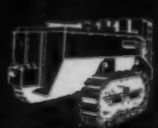

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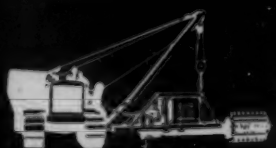

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2. A weld with cracks shall not be acceptable.
3. A weld which lacks complete penetration shall not be acceptable.
4. A weld which lacks complete fusion shall not be acceptable.
5. The maximum dimensions of a single slag inclusion or gas pocket shall not be greater than ⅛ in., except that an elongated inclusion may be ½ in. in length but not more than 1/16 in. in any other direction.
6. The total length of the slag inclusions and/or gas pockets in a 12-in. length of weld shall not exceed 1 in. except as further restricted under Item 7 or 8, and the total length of elongated slag inclusions may be 2 in.
7. The maximum distribution of slag inclusions and/or gas pockets which are not elongated shall not exceed that shown in Fig. 5 which is based on the following conditions:
   LARGE: ⅛-in. maximum size.
   Two discontinuities in 6 in.—minimum distance apart, 2 in.
   MEDIUM: 1/16-in. maximum size.
   Eight discontinuities in 6 in.—minimum distance apart, ¼ in.
   SMALL: 1/32-in. maximum size.
   Sixteen discontinuities in 6 in.—minimum distance apart, ⅛ in.
   FINE: 1/64-in. maximum size.
   Thirty-two discontinuities in 6 in.—minimum distance apart, 1/16 in.
   ASSORTED: ⅛-in. maximum size.
   One ⅛ in., four 1/16 in., eight 1/32 in. and sixteen 1/64 in., or a total of 29 discontinuities in 6 in.—minimum distance apart, ⅛ in.
8. Any group of gas pockets which are in line shall not exceed the maximum distribution shown in Fig. 6 which is based on the following conditions:
   LARGE: ⅛-in. maximum size.
   Two discontinuities in 6 in.—minimum distance apart, 2 in.
   Two in any 3 in.
   MEDIUM: 1/16-in. maximum size.
   Seven discontinuities in 6 in.—minimum distance apart, ¼ in.
   Three in any 2 in.
   SMALL: 1/32-in. maximum size.
   Fourteen discontinuities in 6 in.—minimum distance apart, ⅛ in.
   Four in any 1½ in.
   FINE: 1/64-in. maximum size.
   Twenty-six discontinuities in 6 in.—minimum distance apart, 1/16 in.
   Five in any 1 in.
   ASSORTED: ⅛-in. maximum size.
   One ⅛ in., two 1/16 in., two 1/32 in., three 1/64 in. or a total of eight discontinuities in 6 in.—minimum distance apart, ⅛ in.
   Four in any 1½ in.

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1. "Electric Welded Large Diameter Pipe," The Making, Shaping and Treating of Steel, United States Steel Corp., Sixth Edition, p. 1136, 1951.
2. Wilder, A. B., Crouch, F. W., and Saylor, W. A.: "Radiography as a Control of Weld Quality in the Manufacture of Submerged Arc-Welded Pipe," Division of Production, American Petroleum Institute, San Francisco, June 1954.
3. Wilson, J. L., Claussen, G. E., and Jackson, C. E.: "The Effect of I^2R Heating on Electrode Melting Rate," the Welding Journal, Vol. 35, No. 1, p. 1-S, January 1956.

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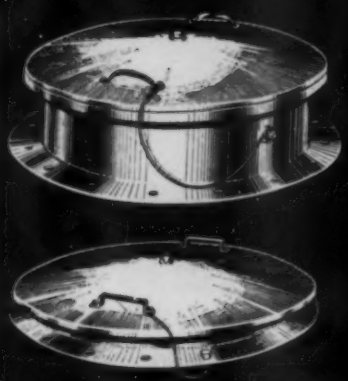
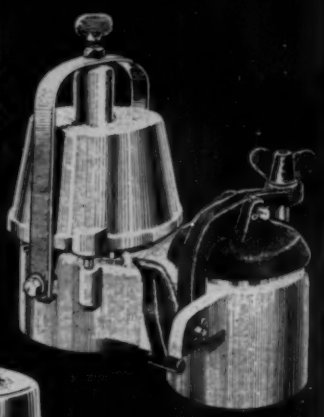
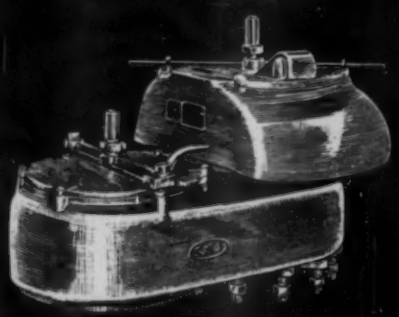


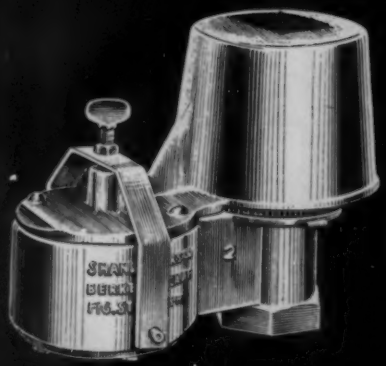
S&J Emergency Vent, Figs. ST-5455 and ST-5455A, provide emergency venting for surges, unusual thermal conditions or over-filling. Fits Standard 20" A.P.I. manholes.

S&J Combination Breather Valve and Gage Hatch, Fig. ST-1615. Economical venting for small marketing and bulk plant tanks.

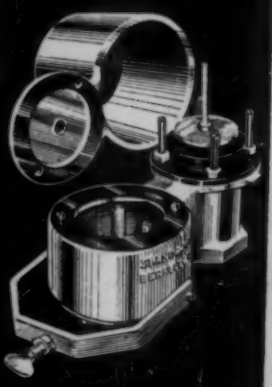




S&J TITE-SEAL Vapor Saving Breather Valve, Fig. ST-7575, designed for vapor conservation systems provides tightest seal against pressures and vacuums below valve settings.



S&J Breather Valve, Fig. ST-3695R features a one piece vacuum-pressure valve cover for quick accessibility. Available in 2, 3 and 4 inch sizes.



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Among the Drilling Contractors

Rex Drilling Co., Shreveport, is on a new contract job for Jones-O'Brien, Inc., also of Shreveport, in the Bethany-Longstreet area, in Caddo Parish, northwestern Louisiana. Contract specifies a 6,700-ft. Travis Peak test. Location, at 1 Rushing, in 17-14n-15w, is about a mile north of a prolific gas-condensate well completed by the same operator last November.

Hilburn Industries, Inc., Shreveport, has a rig working for Austral Oil Exploration Co., Inc., of Houston, on a deep test at a wildcat location 2 miles west of Noxubee, in Columbia County, southern Arkansas. The test, at 1 Biddle, in 26-18s-20w, is set up to go to the Smackover formation about 9,500 ft. Location is 2¼ miles southwest of West Atlanta field, and about the same distance northeast of Brister.

Hayden Farmer Drilling Co. is contractor on a projected 5,000-ft. Woodbine test W. C. Perryman and I. P. LaRue, of Athens, Tex., are starting at a wildcat location (1 Wagers) in the Aaron York Survey, 6 miles southeast of Murchison, in Henderson County, East Texas.

Rutledge Drilling Co., Santa Fe, N. M., reports its five rigs being kept busy on contract jobs. Three are in North Dakota, and two in San Juan County, Utah, in the Four Corners area. In North Dakota, one rig is drilling for Amerada Petroleum Corp., in McKenzie County; another for Sun Oil Co., in Billings County; and the third for Pure Oil Co., in Divide County. In San Juan County, Utah, one rig is working for Carter Oil Co., and the other for Continental Oil Co. Rutledge also reports the transfer of Jack H. Auten from Ray, N. D., to Farmington, N. M., where he is superintendent of drilling operations in the Four Corners area.

Stewart & Richardson Drilling Co., San Antonio, is getting started on a 9,000-ft. contract job at a wildcat location 5 miles north of Monte Cristo, in western Hidalgo County, in Texas' Rio Grande Valley. The test is for Hargrave Oil Corp., at 1 Kathryn Jackson, in Valley Farms Subdivision. Location is about ¾ mile northwest of a gas well drilled by Superior Oil Co. northeast of Monte Cristo field.

Del Mar Drilling Co., Corpus Christi, has a rig under contract to Tri-Mark Oil Co. for a 7,500-ft wildcat test 5 miles east of Petonilla, in Nueces County, lower Texas Gulf Coast. Location is at 1 Geistman, in Section 20, Laureles Farm Tracts. It is about 15 miles southwest of Corpus Christi.

Owen Drilling Co., Overton, Tex., has two new contract operations going in Calcasieu Parish, southwestern Lou-

RECORD BREAKERS—Grady Roper (right), executive vice president of W. T. Burton Industries, Inc., and (left) Joe Barras, tool pusher, and Claude Hoffpauir, drilling superintendent, on Burton's drilling barge operating in Lake Palourde, near Morgan City, in St. Mary Parish, Coastal Louisiana. They supervised the running and cementing of a 15,400-ft. string of 9⅝-in. casing in a deep wildcat test Burton is putting down in the lake for his own account. This is believed to be the longest string of casing of that size ever run. The wildcat, 1 State Lease 2933, now is drilling near 17,000 ft.

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isiana. One is for Sohio Petroleum Co. at 1 Gilbert Fontenot, in the East Bell City area, in the southeastern part of the parish. The other is for **Carter-Jones Drilling Co.,** Shreveport, at 1-A Ranch Farms, in the Coulee Hippolyte area, 5 miles southeast of Lake Charles. Both are 11,300-ft. tests.

C. B. Webster Drilling Co., Houston, is drilling a confirmation test for Southern Natural Gas Co.'s recently completed gas-condensate discovery well in the Montegut area, 15 miles southeast of Houma, in Terrebonne Parish, southeastern Louisiana. It is the operator's 3 South Shore, a southwest offset to the discovery well, productive from a 12,175-ft. sand. Permit is for 14,500 ft.

Pronto Drilling Co., San Antonio, is on a new wildcat operation in southern Zavala County, Southwest Texas. The contractor is joint operator with J. B. Moore and Tandy G. Young in the venture, a 4,500-ft. test. Location is 12 miles northeast of Crystal City, in the Narcisco Aguirre Survey. It is 15 to 20 miles from nearest production.

Frio Drilling Co., San Antonio, has taken on two new contract jobs in South Texas. One is a 10,000-ft. test for Carrl Oil Co., Shore Exploration Co., and George Coates, of Corpus Christi, at 1 Kelly, 6 miles southwest of Corpus Christi, in Nueces County. The other is a 6,500-ft. test for Carrl Oil Co. and Cosden Petroleum Co., at 1 Chapman, 6 miles southeast of Mathis, in San Patricio County.

Southern Six Drilling Co., Opelousas, La., has contracted for a 12,000-ft. test in southeastern Calcasieu Parish, southwestern Louisiana. It will be drilled for Charles H. Wacker, of Houston, at a wildcat location 3 miles southwest of Holmwood, and about 10 miles southeast of Lake Charles. It is about 3 miles northwest of the West Chalkley area. Location is for 1 Helms, in 20-11s-7w.

Rowan Drilling Co., Houston, has a new wildcat operation in St. Charles Parish, southeastern Louisiana. It is California Co.'s 1 Tinkens, a 12,500-ft. test in 35-14s-22e. Location is about 15 miles southwest of New Orleans, in the southeastern part of the parish, in the Lake Cataquatche area.

Index Drilling Co., Laurel, Miss., has a 9,000-ft. wildcat test scheduled in Perry County, southeastern Mississippi. It will be for Fred D. Meyer and others at 1 Michigan-Mississippi Minerals, Inc., in 21-1s-11w. Location is 5 miles northeast of Fruitland Park, and 6 miles east of Maxie field.

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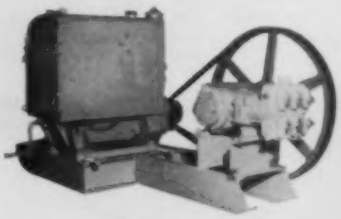

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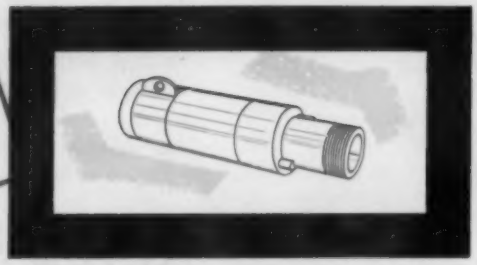


The Barney Coupling and permanent built-in safety clamps

GOODALL RUBBER COMPANY

TRENTON, N. J.

Goodall Rubber Company of Texas: Houston, Odessa, San Angelo, Texas.
Goodall Rubber Company of California: San Francisco, Los Angeles, Seattle, Salt Lake City, Portland.
Goodall Rubber Company: New York, Philadelphia, Pittsburgh, Chicago, Denver, St. Paul, Detroit.

Export: Goodall Rubber Company, Trenton, N. J.
Stocking Distributors: Texas and Louisiana—Houston Oil Field Material Co., Wilson Supply Co., Hunt Tool Co., Heap Equipment Company; Iverson Supply Co.

Available through all qualified supply stores

SHOWCASE...

NEW EQUIPMENT

Liquid-Transfer Case Meters Accurately

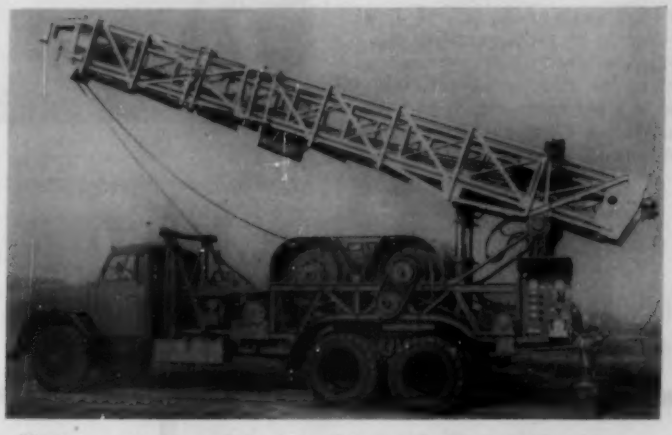
In this new metering liquid-transfer case the features of both liquid-transfer case and a volume meter are combined to provide high accuracy in the metering of liquids during transfer from low pressure to a higher-pressure zone, the maker states. The method of transferring the liquid is by gas pressure.

In operation, liquid flows by gravity into the vessel. When liquid reaches the upper dumping level, the liquid-level-control pilot closes the liquid inlet valve and opens the liquid outlet valve.

When the liquid reaches the low level, the control pilot closes the liquid discharge valve and opens the liquid inlet valve. Simultaneously, it closes the inlet gas valve and opens the outlet gas valve. This allows the liquid to accumulate until it reaches the upper dumping level. This completes a cycle which is registered on a counter or recorder.

The CV-LTC liquid-transfer case and volume meter combination is specifically designed for use where precise metering accuracy is needed.

Two of the applications for the liquid-transfer case are in the transfer of tank bottoms to an emulsion treater and for the disposal of salt water from a treater. **Write or call: Oil Metering & Processing Equipment Corp., 4843 Yale Street, Houston 18, Tex., for details on metering liquid-transfer case.**



Well-Servicing Hoist Has Direct Drive

On this German-made truck-mounted Type AwHL 150/2 hoist for well servicing, the two hoist drums are driven by the truck engine through a torque converter. The torque converter has a direct-drive range. At a certain relationship between the output speed and the engine speed, a built-in friction clutch, automatically operated by hydraulic controls, comes into action without interrupting the power.

The advantage of this direct-drive range is that, especially at small loads, a favorable efficiency can be obtained. For the same purpose, a two-speed gear box has been provided behind the torque converter. Operated by air-actuated clutches from the operator's stand, it allows changing from the first speed to the second speed, or vice versa, without stopping the hoist. The two-speed gear box also has two reverse speeds which can be operated by air from the operator's stand.

The two hoist drums are free running on roller bearings, providing easy reversal of the drums.

Another feature of the hoist is its

Send this **Showcase Coupon**

to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

.....

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Described in OIL AND GAS JOURNAL - Issue of April 8, 1957

NAME.....TITLE.....

COMPANY.....

ADDRESS.....

CITY.....STATE.....

DATE.....

New Equipment

air-pillow friction clutches which work directly at the drums. Each of the air pillows can be set out of action in case of a defect. But the clutches can still be used.

The exchange of the pillows as well as exchange of the brake rims can be made in a few minutes, without dismantling the clutches or drum shafts. **Write or call: Eisenwerk Wulfel, Hannover-Wulfel, Germany (British Zone), for details on Type AwHL 150/2 hoist.**

Twin-Engine Plane Carries Big Payload

This new model Aero Commander twin-engine executive airplane, designated the 560-E, features many improvements over other 560 Commanders. These include extended 49-ft. high-aspect wings, an increase in gross weight to 6,500 lb. to provide a greater payload, and a one-stop coast-to-coast range of 1,625 miles.

Extending the range to 1,625 miles is obtained by the installation of fuel tanks outboard of the engine nacelles. The fuel and oil systems provide a total of 223 usable U. S. gallons of fuel and 8½ gal. of oil. The plane has a 222 m.p.h. top speed—15 m.p.h. over the 560-A.

Lycoming engines power the plane. These engines have a normal rating of 285 hp. at 3,100 r.p.m. and a takeoff rating of 295 hp. at 3,400 r.p.m.

The electrical system is 24-volt type. Power is supplied by two 50-amp. high-speed generators. A 34-amp.-hr. battery is located conveniently beneath the rear seat. **Write or call: Aero Design & Engineering Co., Box 118, Bethany, Okla., for details on Model 560-E airplane.**

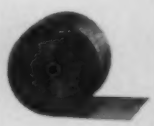
●

Reinforcing Welding Neck May Reduce Welding

Here's a new seamless, heavy reinforcing forged-steel welding neck designed to eliminate the need for a reinforcing pad and extra welding. Hy-

J-M Asbestos and Tar Felt

C-R-C Glass Wrap


C-R-C Outer Wrap

CRC

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Now you can fill all your pipeline needs from pipe wraps to pipe "pigs" from ONE supplier, Crutcher-Rolfs-Cummings, Inc.

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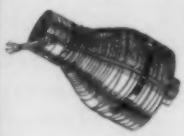
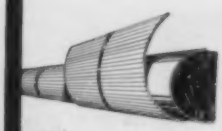
C-R-C IMCO Bevelers
C-R-C Dope Kettles
T&R Holiday Detectors

Casing Insulators

Scraper "Pigs"


Casing Seals


Sealtight Rock Shield

CRC

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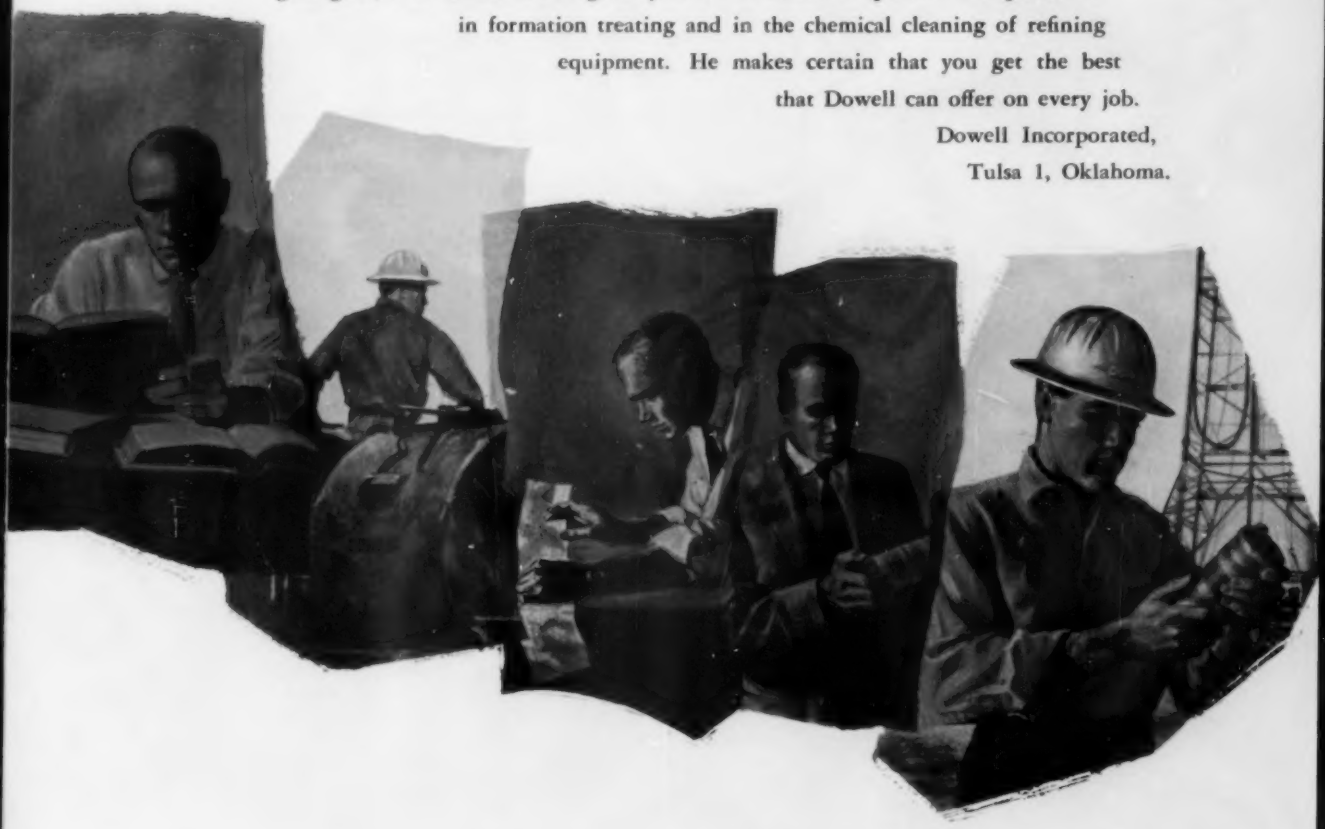
Your DOWELL man is many men

He has to be! Your oil and gas well production problems are many problems. Sure, they all relate to greater recovery, but there's no one way to get it. That's why your Dowell man is an engineer, a geologist, an oil man.

That's why, in effect, the whole company moves in on your job. The Dowell man in charge becomes many men: our entire organization of engineers, geologists, and scientists. He gives you all of Dowell's specialized experience in formation treating and in the chemical cleaning of refining equipment. He makes certain that you get the best that Dowell can offer on every job.

Dowell Incorporated,
Tulsa 1, Oklahoma.



Services for the oil industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

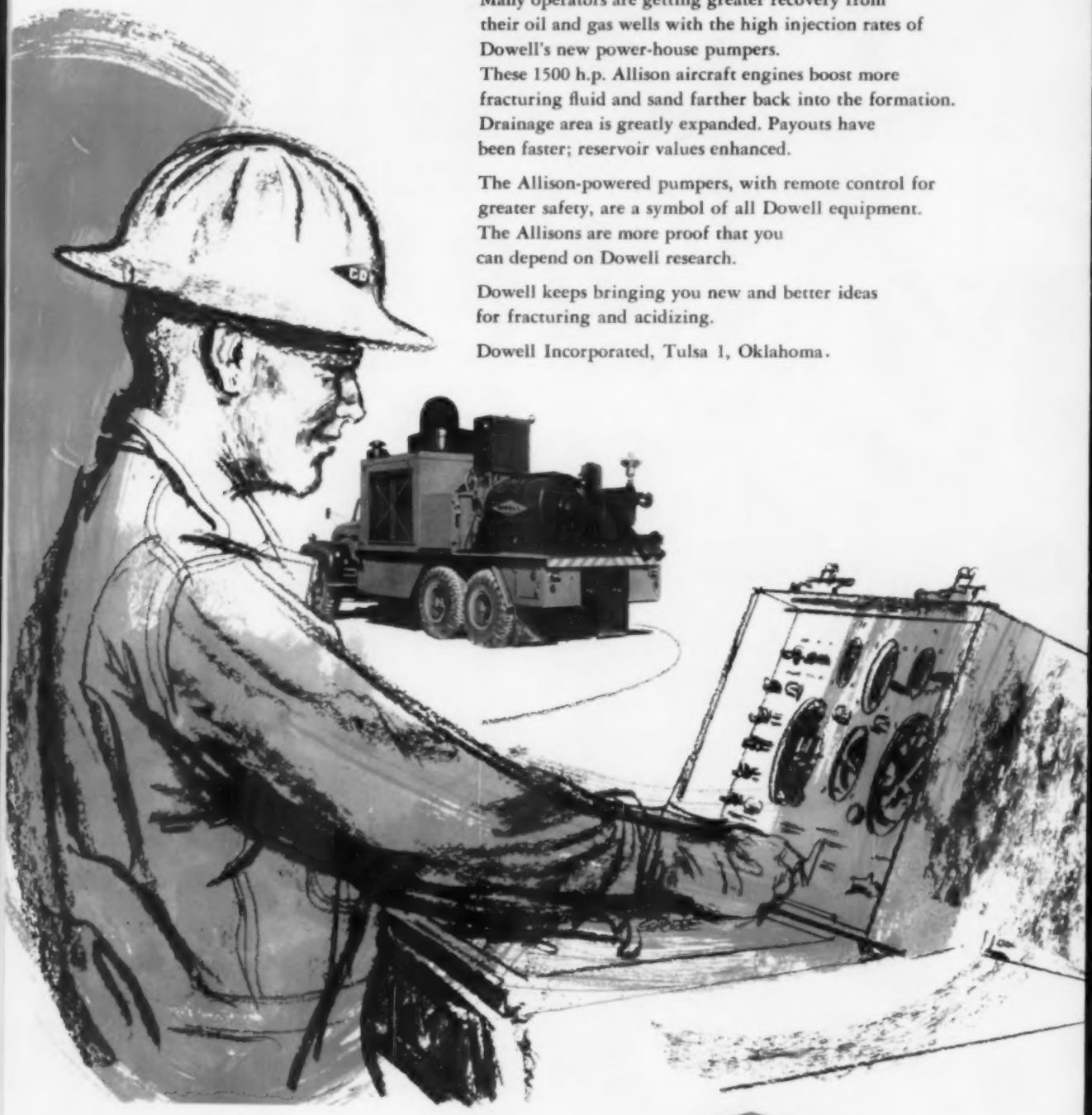
More power for greater recovery

Many operators are getting greater recovery from their oil and gas wells with the high injection rates of Dowell's new power-house pumpers.
These 1500 h.p. Allison aircraft engines boost more fracturing fluid and sand farther back into the formation. Drainage area is greatly expanded. Payouts have been faster; reservoir values enhanced.

The Allison-powered pumpers, with remote control for greater safety, are a symbol of all Dowell equipment. The Allisons are more proof that you can depend on Dowell research.

Dowell keeps bringing you new and better ideas for fracturing and acidizing.

Dowell Incorporated, Tulsa 1, Oklahoma.



Services for the oil industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

New Equipment

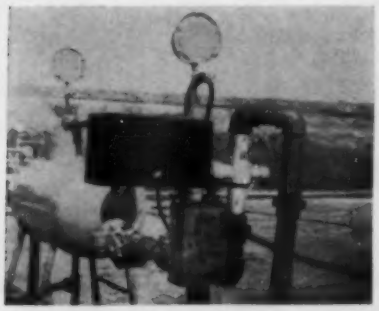
draulic forging assures seamless construction and high strength, without distortion strains or internal fracture from sudden impacts, the maker claims.

The straight-through pipe-schedule bore of the Type H neck eliminates the possibility of a turbulence-causing shoulder as on standard necks. And it increases corrosion resistance.

Only one wrench is required to attach a cover to the flange with bolts, since the outside diameter is normally made to nut-stop dimensions.

The neck is available in 300 to 1,500 lb. A.S.A. specifications in sizes ranging from 2½ to 24-in. i.d. **Write or call: Lenape Hydraulic Pressing & Forging Co., Dept. 105, West Chester, Pa., for details on Type H welding neck.**

●



Automatic Line Sampler Simplifies Sample Taking

Thiefing a sample from a tank may be eliminated by this new automatic oil-line sampler. Called the Super Thief, the sampler can be installed at the well head. Samples are automatically taken at predetermined intervals. The sampler can also be placed on the upstream side of the gas trap.

All that is required to use it is to turn on the switch and return at the end of 24 hours to pick up the sample. Then the normal procedure of centrifuging will determine the cut.

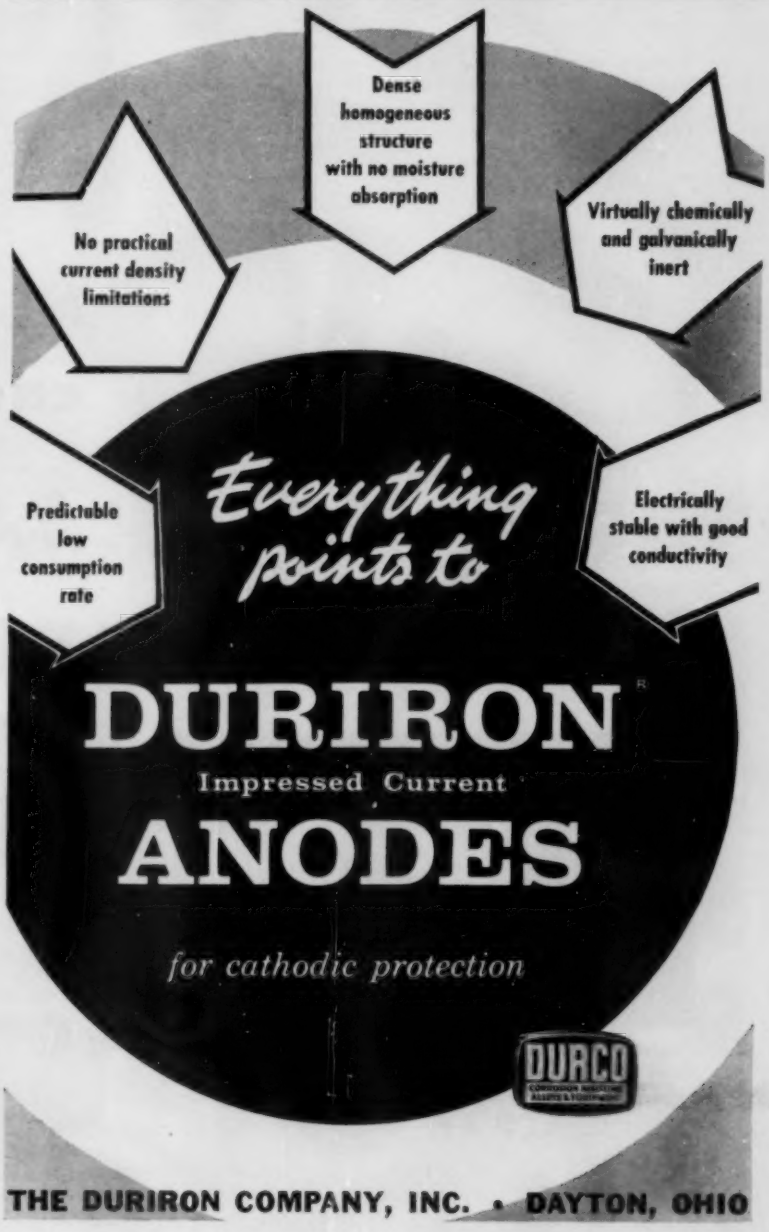
After 2 years of research, the sampler has shown that it can take a cross-section sample of the production without disturbing the flow or building up any backpressure whatsoever, the maker states.

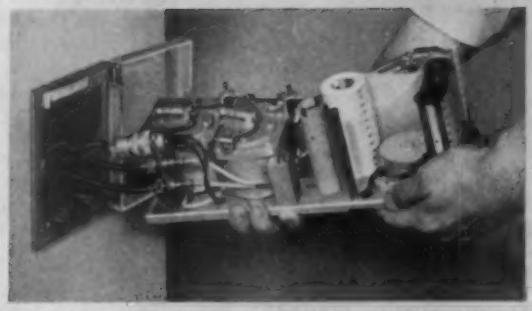
The line sampler is said to meet all specifications required by the A.P.I. under Standard Bulletin 2500, issued October 1956. **Write or call: Svenska Mfg. Corp., 1305 West 135th Street, Gardena, Calif., for details on Super Thief.**

Induction Heating Unit Simplifies Preheating

With this new 400-cycle induction type of heating unit, preheating and stress relieving can be carried out in one continuous cycle—without moving the weldment for furnace treatment or other operation, the maker reports. It employs a Brown strip-chart proportional-program controller for over-all temperature regulation.

This instrument is adjustable to any desired schedule of heating, soaking, and cooling rates. When preset to a program, it provides fully automatic and continuous temperature control.

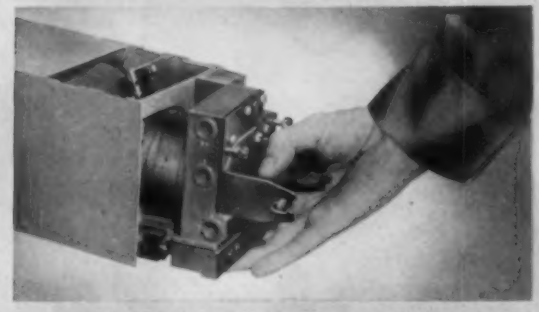




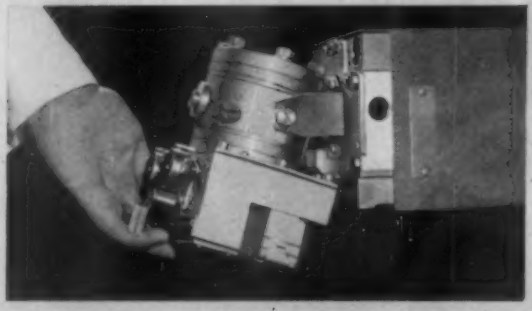
Easily Serviced—All parts can be inspected during operation, without process interruption. To remove chassis completely, unscrew three finger-tight, self-sealing connections.

Interchangeable Chassis—Change recorder to indicator or vice versa without interrupting control. Simply pull out chassis, slide another in place.

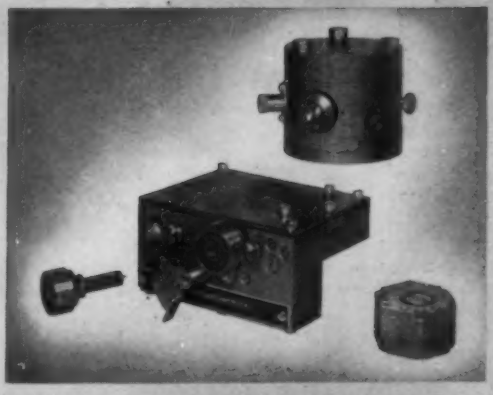
Now you can gain ... *Extra*



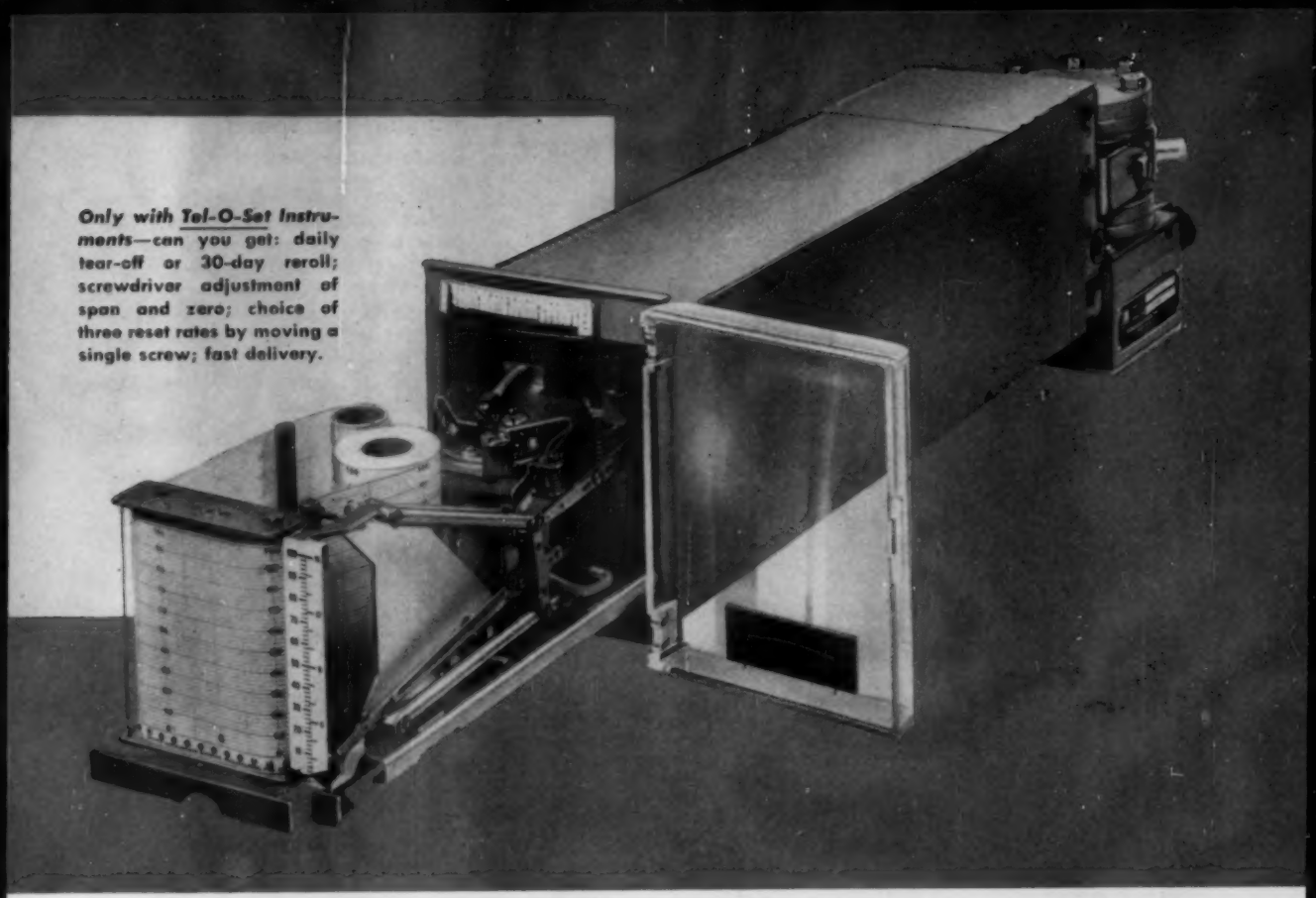
Removable Regulator—Pneumatic assembly, consisting of regulator and switches, can be removed from rear of case without disturbing electrical connections—no need for an electrician to stand by.



Quick-connect Mounting—Controllers have quick-connect switch permitting removal of the unit while process remains on manual control.



Easily Disassembled—Unitized construction of all controller components simplifies maintenance . . . makes reassembly foolproof. No need to dismantle stack to clean pilot assembly.


Only with Tel-O-Set Instruments—can you get: daily tear-off or 30-day reroll; screwdriver adjustment of span and zero; choice of three reset rates by moving a single screw; fast delivery.

Savings with TEL-O-SET*

. . . advanced miniature pneumatic instruments

Tel-O-Set miniature instruments accurately record, indicate, and control process variables. They're applicable to any process variable . . . a savings in itself. And, further savings are accrued from these factors: Only a few models are needed for *all* applications . . . Personnel training time is minimized . . . Spare parts inventory is reduced . . . Process techniques can be changed without buying new instruments. The photographs point up some of the outstanding *Tel-O-Set* features.

For complete information on *Tel-O-Set* instruments, write for Catalog C 1001-1, or call your nearby Honeywell sales engineer. He's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

*Trade name Minneapolis-Honeywell Regulator Co.

H HONEYWELL

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

SHOWCASE . . .

New Equipment

After the weld is completed, the instrument automatically starts the desired stress-relieving program.

In addition, a permanent, accurate record of the entire program is provided on the instrument chart, allowing efficiency and usage calculations to be made as desired. **Write or call: Hobart Brothers Co., Troy, Ohio, for details on 400-cycle induction-heating unit.**

Marking Ink Speeds Drum-Head Stenciling

Marking on metal or any nonporous surface can be done with this new Rol-It-On nonporous marking ink for use with the Rol-It-On roller-process stenciling system. Available in several colors, the ink has excellent covering power and dries instantly, the maker claims. Thus metal drum heads can be marked fast and efficiently. **Write or call: Diagraph-Bradley Industries, Inc., P. O. Box 269, Herrin, Ill., for details on Rol-It-On marking ink.**

●

7326-HC

Corrosion has an expensive appetite

PROTECT YOUR INVESTMENT WITH A Harco CATHODIC PROTECTION SYSTEM

If you can afford the bill . . . enjoy your guest. But remember . . . you've got this guest whether you can afford her or not. Check your profits . . . and see what this appetite is costing you regularly.

Electrolytic corrosion is the biggest single destroyer of buried or submerged metal structures and pipelines.

IT CAN BE STOPPED. That's where HARCO comes into the picture. It's our business to protect your investment. We are the specialists who can prevent and cure electrolytic corrosion . . . QUICKLY AND ECONOMICALLY. It is a fact . . . most cathodic protection systems pay for themselves in a matter of months . . . just through savings in normal maintenance and replacement costs.

HARCO regularly supplies a complete range of services. Whatever your needs . . . engineered systems, contract installations or materials . . . LOOK TO HARCO . . . FIRST IN THE FIELD OF CATHODIC PROTECTION!

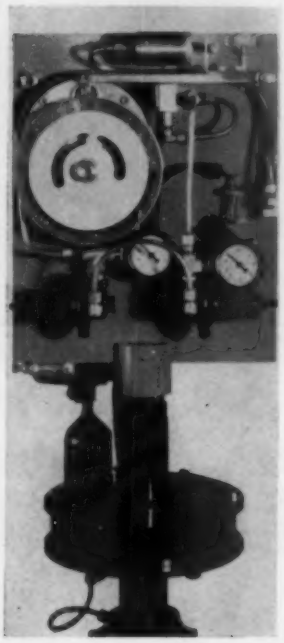
Write today for catalog or call MOntrose 2-2080.

Harco

CATHODIC PROTECTION DIVISION

THE HARCO CORPORATION

16961 Broadway • Cleveland, Ohio

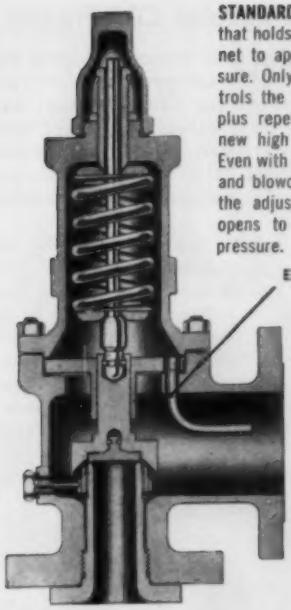


Surface Intermitter Does Variety of Chores

This McMurry Type A-NC surface intermitter is a multipurpose tool. It may be used in many applications, particularly gas lift and subsurface plunger work.

It can be used: (1) as a gas-lift intermitter with casing-pressure buildup control, (2) as a surface controller with automatic shutoff in conjunction with a plunger along with low-pressure shutoff or surge control, (3) as a surface controller for stop-cocking of flowing wells with low-pressure shutoff control, (4) as a gas-lift intermitter with tubing-pressure control, (5) as a backpressure or pressure-reducing regulator, and (6) in other combinations of the above applications.

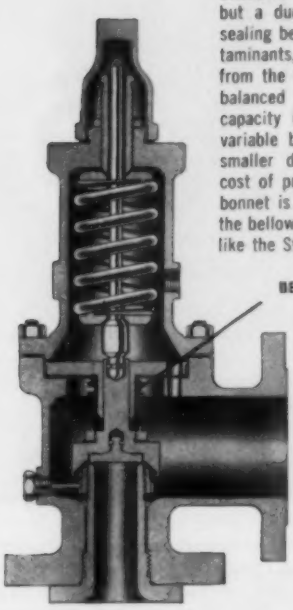
The design of the tool is simple. The weight bar is provided with travel



STANDARD VALVE. Note the eductor tube that holds the pressure in the valve bonnet to approximately atmospheric pressure. Only the force of the spring controls the valve. Far better valve action plus repetitive flow capacity assure a new high in operational dependability. Even with repeated popping, set pressure and blowdown are consistent. Whatever the adjusting ring position, the valve opens to full capacity at 10% overpressure.

LOOK INSIDE

before you buy another safety relief valve



BELLOWS VALVE. Similar to the Standard, but a durable, two-ply stainless steel sealing bellows effectively isolates contaminants, corrosion or viscous fluids from the working parts. The bellows is balanced with the seating surface — capacity is less seriously affected by variable back pressure, so the use of smaller discharge piping reduces the cost of pressure-relieving systems. The bonnet is vented to the atmosphere. If the bellows ruptures, the valve operates like the Standard valve.

CERTIFIED AND APPROVED. Both Standard and Bellows Valves are approved under ASME Unfired Pressure Vessel Codes and are certified by the National Board of Boiler and Pressure Vessel Inspectors.

LOOK INSIDE the Consolidated Safety Relief Valve. Fewer functional parts and precision machining and alignment of parts assure long valve life and less maintenance. Economical "2 in 1" design permits the Standard valve to be converted to the Bellows type right in your own shop.

There is only one adjusting ring—it can be set easily *before* valve installation to obtain peak performance at 4-5% blowdown. *Full-rated relieving capacity* is certain at all positions of the ring because a fixed maximum secondary orifice provides full lift at 10% over-pressure. *Valve action is consistently positive* even where "superimposed" back pressure is in the relieving system.

The temperature-compensating disc eliminates seat distortion caused by temperature-induced stresses — always seats tightly even when reasonable strains of unanchored discharge piping are present. A minimum guiding area is provided to align the seating surfaces — less chance of a sticking disc holder when corrosion or contamination build up on the guiding surfaces. The seating surfaces are optically-ground flat for easier, more economical servicing.

The contours of the huddling chamber and secondary orifice take full advantage of the stream pressure and kinetic forces. No other valve has this safety feature. Note the low placement of the threaded section that holds the nozzle in the valve. It assures high resistance to discharge piping strains — no leakage resulting from strain induced into the nozzle.

BE SURE OF ABSOLUTE PROTECTION for personnel and equipment — plus low maintenance. Select Consolidated Safety Relief Valves. Full range of sizes and pressures available with standardized inlet and outlet face-to-face dimensions for easy interchangeability with the valves of some other manufacturers. *Write for Catalog 1900.*

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario.*

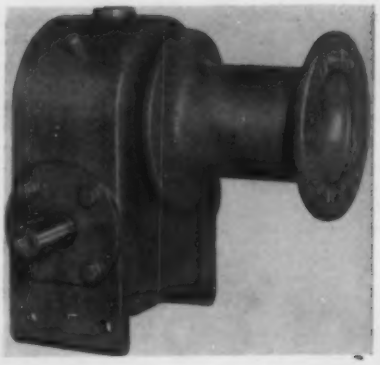
CONSOLIDATED SAFETY RELIEF VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** TULSA, OKLAHOMA

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Okla.* AIRCRAFT CONTROL PRODUCTS, *Danbury, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

at its fixed rate. The rotation of the clock drives the weight bar to the left until it can move no farther in that direction.

Many combinations may be obtained with this arrangement. Length of travel of the weight bar can be adjusted if desired. **Write or call: McMurry Oil Tool Specialties, 1020 Houston Avenue, Houston, Tex., for details on surface intermitter.**



Speed Reducer Cuts Friction

Here's a new worm-gear speed reducer which incorporates antifriction ball bearings for both the input and output shafts. Labeled the Model G4S, the reducer provides a 29 to 1 reduction. Rated at 875 lb.-ft. of output torque, it's designed for intermittent operation.

Its weight is held to 36 lb. by the use of a cast-aluminum housing. The reducer can be driven by electric, gas, or hydraulic motor or manually—or by a single-speed power takeoff, if truck mounted. **Write or call: Tulsa Winch Co., 817 East First Street, Tulsa, Okla., for details on Model G4S speed reducer.**

●

HE'S THE MAN who helps your pipe coating jobs move along smoothly — on schedule. He's there before the kick-off, making sure that enough LION E-120 asphalt coating is on hand, packaged in easy-to-open containers which one man can handle. He checks all equipment, inspects the kettles, adjusts the shoes and makes a careful examination of all surfaces to be coated. He's your HOLCOMBE service engineer.

That's one big reason why company inspectors "OK" the first application of LION E-120—that's why contractors move right along according to schedule — without a hitch.

So on your next pipe coating job, no matter how big or how small, let us know in advance. We'll see that you have an experienced HOLCOMBE engineer at the site, well ahead of kick-off time.

Write for complete specifications of LION E-120 *asphalt coating and literature on other* HOLCOMBE *corrosion prevention products.*

THE HOLCOMBE COMPANY, INC.
FIRST NATIONAL BANK BUILDING TELEPHONE 5-3468
SHREVEPORT, LOUISIANA
HOLCOMBE COMPANY OF CANADA, INC.
323 BARKER BUILDING TELEPHONE 6-7291
CALGARY, ALBERTA, CANADA

Lion Coatings • Holcombe Selenium Rectifiers
Pipe Wrappings • Graphite Anodes • Coke Breeze

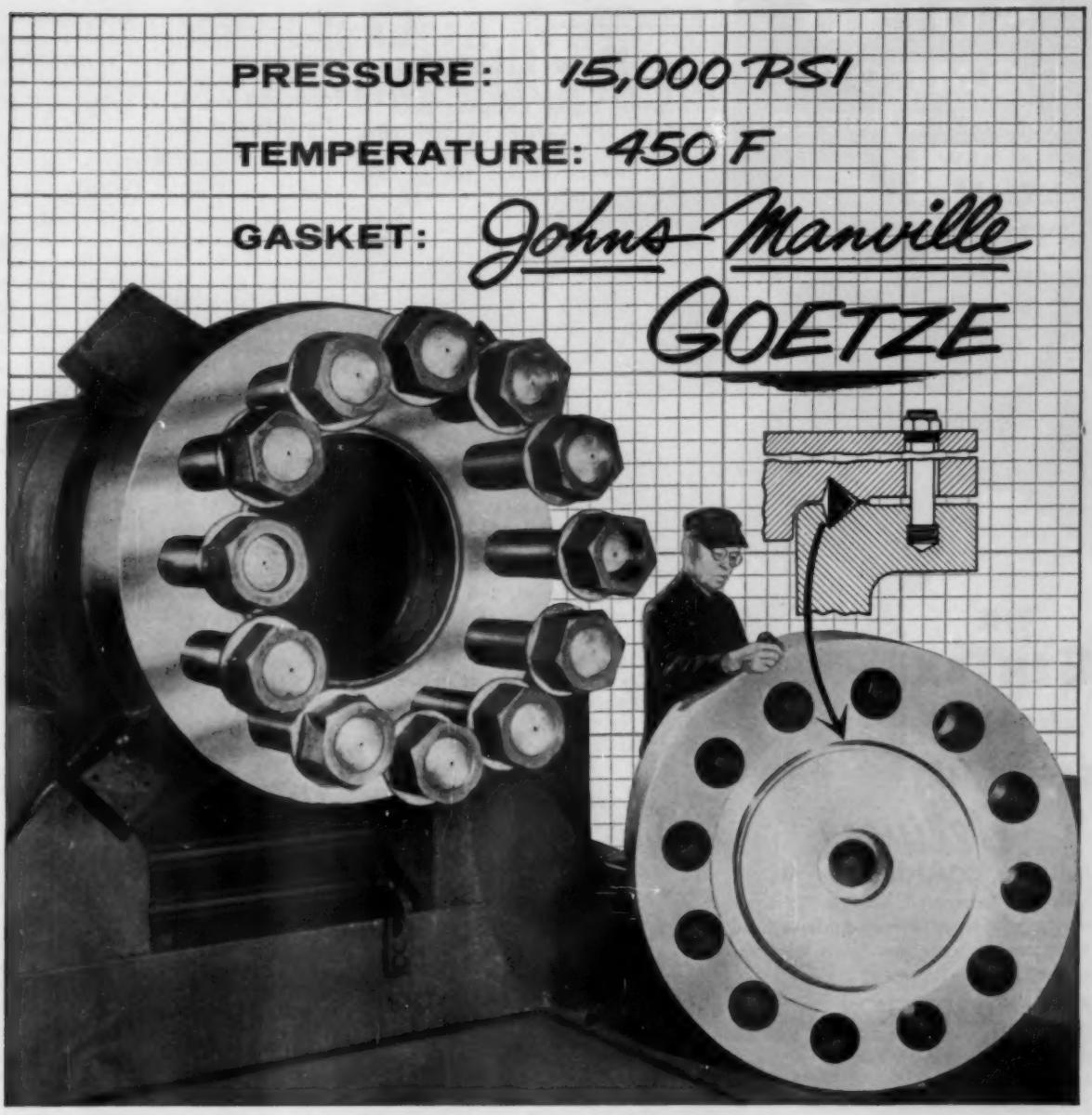
Pressure Transmitter Doubles as Field Gage

Built for pneumatic transmission of process pressure measurements, this new Foxboro indicating pressure transmitter is accurate to ±0.5 per cent of scale range. Called the Model 44, it measures pressures ranging from 0 to 30 in. of water to 0 to 6,000 psi., transmitting a 3 to 15-psi. air signal to indicating, recording, or controlling instruments.

To accommodate the various ranges, a choice of standard pressure elements is available, including spirals, helicals, bellows, and diaphragms. And element materials are available for corrosive process fluids.

Eliminating the need for a separate field gage, the transmitter has an eccentric indicating scale, 4⅛ in. long, built into the front of the case. The scale's red pointer and black-on-white markings are visible from as far away as 20 ft., providing indication at the point of measurement.

The transmitter is only 8⅛ in. high, 5⅞ in. wide and 4⅛ in. deep. It weighs 8 lb. **Write or call: Foxboro Co., Foxboro, Mass., for details on Model 44 pressure transmitter.**



How A. O. Smith maintains tight seals in giant "Multi-Layer" vessels

Today's tremendous pressures and temperatures have placed special demands on manufacturers of processing equipment. A. O. Smith has answered this need with a special type of "Multi-Layer" vessel construction. And Johns-Manville in turn has provided gaskets that assure tight seals under these exacting conditions. Typical of these is the delta type gasket, illustrated above, which was designed, for this application, to withstand pressures up to 15,000 psi. and temperatures to 500 F.

The development of special gaskets to meet special purposes has been the stock in trade of Johns-Manville's Goetze division for more than sixty-five years. Expert technicians possess a knowledge of metals and other factors related to gasket design and performance that is unmatched in the field. What's more, intensive specialization and modern production tooling provide substantial cost savings on J-M gaskets.

If you need gaskets for high pressure vessels for similar applications, send us a drawing or template for quotation. If you have a sealing problem of any kind, J-M technicians will work directly with your own engineers to develop new gaskets —or adapt existing styles—to meet your specific requirements. Write for further information to Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit (Toronto), Ontario.

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COMFORT
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AT A NEW
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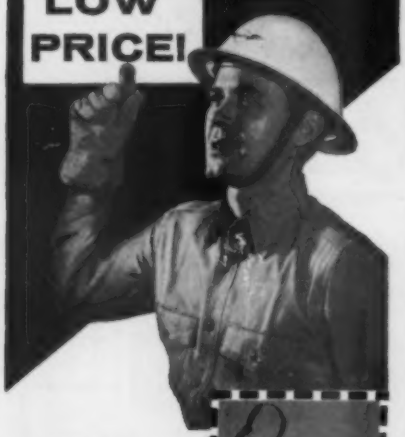

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SHOWCASE . . .

New Literature

Electronic Digital Computer made in England and capable of performing arithmetical operations at an average rate of 180 microseconds per operation is described in this new 12-page brochure. Titled "An Introduction to the Farranti Mercury Computer," the bulletin explains the benefits and usefulness of the computer, its speed of operation, and some of its applications in speeding up engineering design calculations. **Write or call: Ferranti, Ltd., Hollinwood, Lancashire, England, for brochure on Mercury computer.**

●

Offshore Supply Vessels, oil barges, crew boats, and water taxis are among the vessels illustrated in this two-page data sheet. In total, the data sheet pictures 26 different vessels for marine service. Other vessels pictured include tugs, drilling barges, tow boats, and cement vessels. These photographs provide a quick picture of the maker's line of floating equipment for offshore and seagoing use. **Write or call: Equitable Equipment Co., Inc., 410 Camp Street, New Orleans 12, La., for data Sheet SD-398.**

●

Temperature Control Bulletin 106 covers the Burling Model L-1S temperature control for use in either liquids or gases at temperatures up to 1,000° F. The bulletin furnishes a description of the control's differential-expansion operation and specifications giving its temperature ranges, tube sizes, and accuracy. **Write or call: Burling Instrument Co., 16 River Road, Chatham, N. J., for Bulletin 106.**

●

Materials Handling Equipment. Handy pocket-size Circular 163 (14 pages) presents the complete line of Chisholm-Moore hand and electric hoists and related overhead materials-handing equipment. The circular includes illustrations, descriptions, and basic specifications of various models of electric hoists, hand hoists, pullers, cranes, and I-beam trolleys. **Write or call: Chisholm-Moore Hoist Div., Tonawanda, N. Y., for Circular 163.**

●

Industrial Data Systems. Reprint R-98 traces the development of the industrial-data sheet and forecasts its role in the future development of closed-loop automation systems. It gives important definitions of reliability for electro-mechanical and electronic components, noting how such definitions can aid in the design of systems incorporating both types of devices. **Write or call: Beckman Instruments, Inc., 2500 Fullerton Road, Fullerton, Calif., for Reprint R-98.**

●

Teflon Lined Pipe made in 1, 1½, 2, and 4-in. diameters, and 2, 5, and 10-ft. sections is described in new two-page Bulletin T-100. It details the application of Teflon as a liner for Schedule 80 steel pipe. The bulletin gives the thermal, mechanical, and chemical properties of the lining. **Write or call: Halocarbon Div., Haveg Industries, Inc., 900 Greenbank Road, Wilmington 8, Del., for Bulletin T-100.**

●

Tin Box and Steel-Drum Machinery is the subject of this 202-page catalog. Made in England, the equipment is available in automatic, semiautomatic, and hand-operated types. It includes presses, guillotine shears, notchers, folders, hemming and beading machines, formers, flangers, and seamers. Divided into nine sections, the catalog includes over 100 photographs illustrating the equipment. It furnishes an explanation of the equipment and its complete specifications. **Write or call: Moon Bros., Ltd., Beaufort Road, Birkenhead, England, for catalog on tin box and steel-drum machinery.**

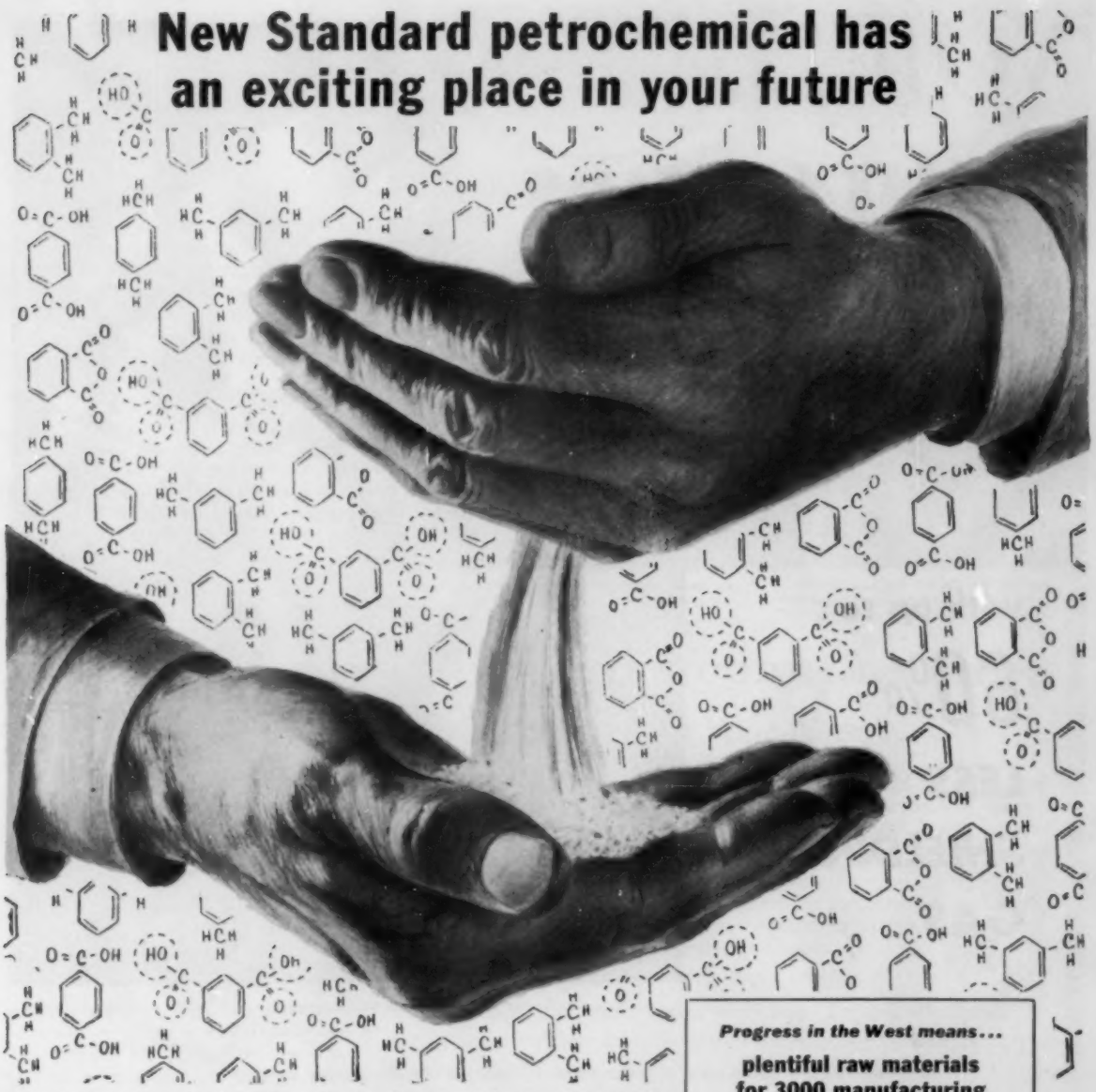
●

Two-Channel Rectilinear Recorder described in new Bulletin R-501 (six pages) permits two functions to be monitored simultaneously in their true wave forms. The recorder uses a single chart drive and records the two variables on a two-channel rectilinear chart with a common time base. Clear cutaway views keyed to text describes and illustrates the interior design features of the recorder and explain how it can be valuable for fast and easy data reduction. **Write or call: Texas Instruments, Inc., Industrial Instrumentation Div., 3609 Buffalo Speedway, Houston, Tex., for Bulletin R-501.**

●

Industrial Engines available in 4, 6, and 8-cylinder models are set forth in 12-page Publication 825, Fourth Edition. Devoted to Rolls-Royce oil engines, the bulletin completely describes the engines and their components. And it includes curves for each engine showing its performance, both unsupercharged and supercharged. All engines operate on the four-stroke-cycle principle. The crankcase is so designed that the wheelbase and flywheel housing

New Standard petrochemical has an exciting place in your future



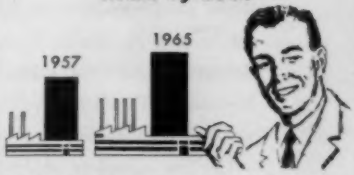
Hundreds of thousands of man hours in research produced these crystals that will revolutionize many paints and plastics.

HOUSE PAINTS THAT LAST YEARS LONGER, superstrong lightweight luggage, improved fibre-glass fishing rods and boats . . . these are some of the things that will come from Isophthalic*, a new petrochemical from Standard laboratories. Even though its possibilities have only begun to be explored, we have invested in a multi-million dollar plant to manufacture Isophthalic.

We're convinced it will make as important a change in your life as detergents, wrinkle-resistant fabrics and other modern wonders whose basic materials were products of Standard research.

Progress in the West means...

plentiful raw materials for 3000 manufacturing firms by 1965



Standard's economists say: "New products from Isophthalic will help provide employment for the 600,000 new workers in manufacturing the West will have by 1965."

*Manufactured and distributed by Standard's wholly owned subsidiary, Oronite Chemical Company.

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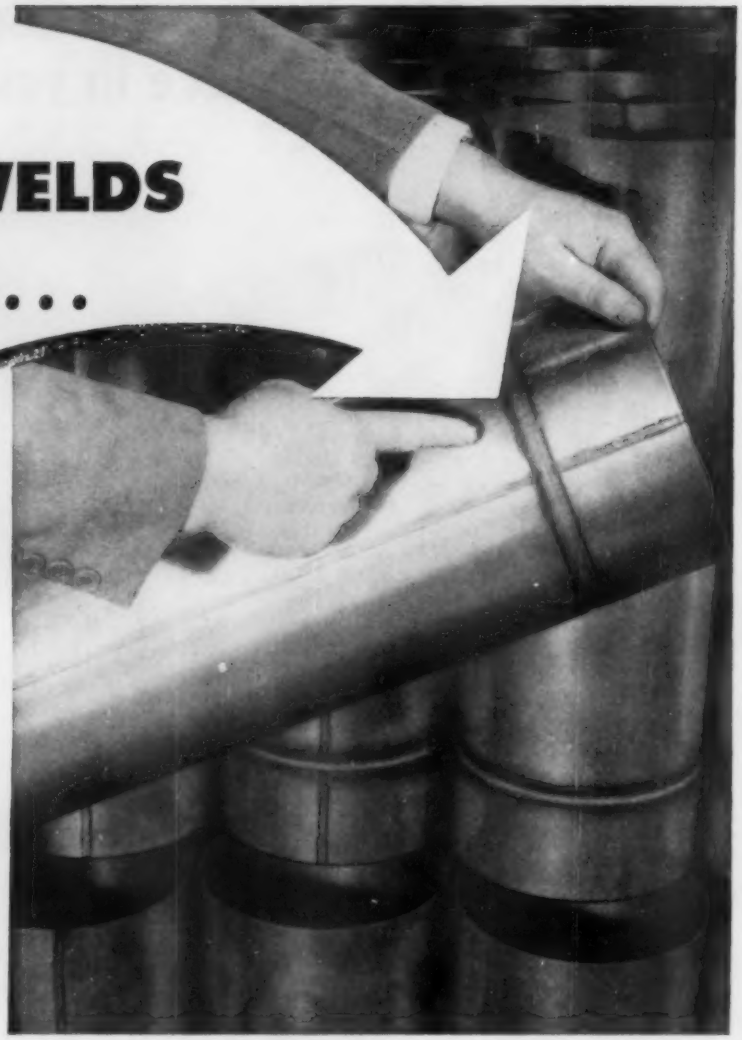
QUALITY WELDS *like these...*



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Using H-15, a LINDE mixture of argon and hydrogen shielding gases, savings as high as 60% of normal gas consumptions are being attained by manufacturers on a wide variety of metal products. This mixture is designed for extremely efficient mechanized welding of stainless steel, Monel, Inconel, and cupro-nickel.

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Trade-Mark

can be fitted to either end. Photographs illustrate the variety of uses for the engines and drawings furnish their installation dimensions. **Write or call: Rolls-Royce, Ltd., Derby, England, for Publication 825.**

●

Specialty Valves for the oil and chemical industries are detailed and illustrated in two-page Bulletin GV-21. The new bulletin describes Greenwood gate-valve line blinds, horizontal check valves, quick-closing valves, self-closing sampling valves, and automatic drain valves. Made of cast-steel construction, the line blinds come in sizes of 2 to 20 in. with working pressures of 150, 300, and 600 psi. in three types—straight, tee, and ell. Made in sizes of 2 to 10 in., the check valve is also available in working pressures to 600 psi. **Write or call: Vernon Tool Co., Ltd., 1101 Meridian Avenue, Alhambra, Calif., for Bulletin GV-21.**

●

Vehicles for Oil Field Service are included in the transportation equipment described in this package of 11 bulletins. The bulletins describe a line of vehicles designed for heavy-duty service. The vehicle for oil-field service is powered with a 182-hp. engine developing 388 ft.-lb. of torque at 1,600 r.p.m. Its front-axle rating is 15,000 lb., and its tandem axle rating is 34,000 lb. The over-all strength of the wheel base is 241 in. **Write or call: Crane Carrier Corp., P. O. Box 5008, Tulsa, Okla., for bulletins on trucking equipment.**

●

Seismic Magnetic - Recording System Catalog C-1 describes a system designed for multipurpose applications. It may be used as a conventional reflection seismograph, as a high-frequency reflection seismograph and also as a refraction seismograph. According to the new catalog, it is a versatile system featuring portability and the capacity to handle a wide frequency range of signals with minimum distortion. The catalog illustrates the equipment and presents its specifications. **Write or call: Seismograph Service Corp., P. O. Box 1590, Tulsa, Okla., for Catalog C-1.**

●

Cushioned Float Valves in sizes from 2½ to 36 in. for use in elevated tanks, reservoirs, coagulating basins, and mixing chambers are the subject of 16-page Bulletin W-5. The valves are designed for either cold or hot-water service in either the quick-opening or throttling design with integral or remote pilot control. The bulletin contains parts lists, dimensions, approximate

PHOTO - COURTESY SERVICE PIPE LINE COMPANY

VAREC PULSE CODE RECEIVER INSTALLATION AT FT. LARAMIE STA. OF SERVICE PIPE LINE COMPANY

"Varec" PULSE CODE telemetering

Tailored To Your Needs...

In addition to giving an accurate signal on liquid level readings over long distances and doing it in the record time of 5 seconds, the "Varec" PULSE CODE Telemetering System can now perform a great variety of operations. Some idea of the system's flexibility can be obtained by checking these optional features:

1. Pulse Code Receivers with provisions for indicating liquid level, temperature, motor valve or other equipment status, abnormal or alarm conditions and other data as required.
2. Systems incorporating two or more receivers.
3. Systems incorporating two or more receivers and selectors.
4. Receiver with terminal provisions for connecting with data printer.
5. Digital clock to be used in conjunction with data printer.
6. Serial entry data printer such as an electric typewriter.
7. Parallel entry data printer such as a ribbon type adding machine.
8. Data Programmer to link Pulse Code receiver to data printer
9. Contactor units to provide "on — off" remote control of equipment such as pumps, motor-driven valves, etc.
10. Scanner unit to provide automatic scanning for data logging on a pre-determined time schedule.

With this wide selection of combinations, your "Varec" PULSE CODE System can be custom-built for your particular process..

Write for "Varec" Bulletin CP-3011 for full details of "Varec" PULSE CODE Telemetering

961-20

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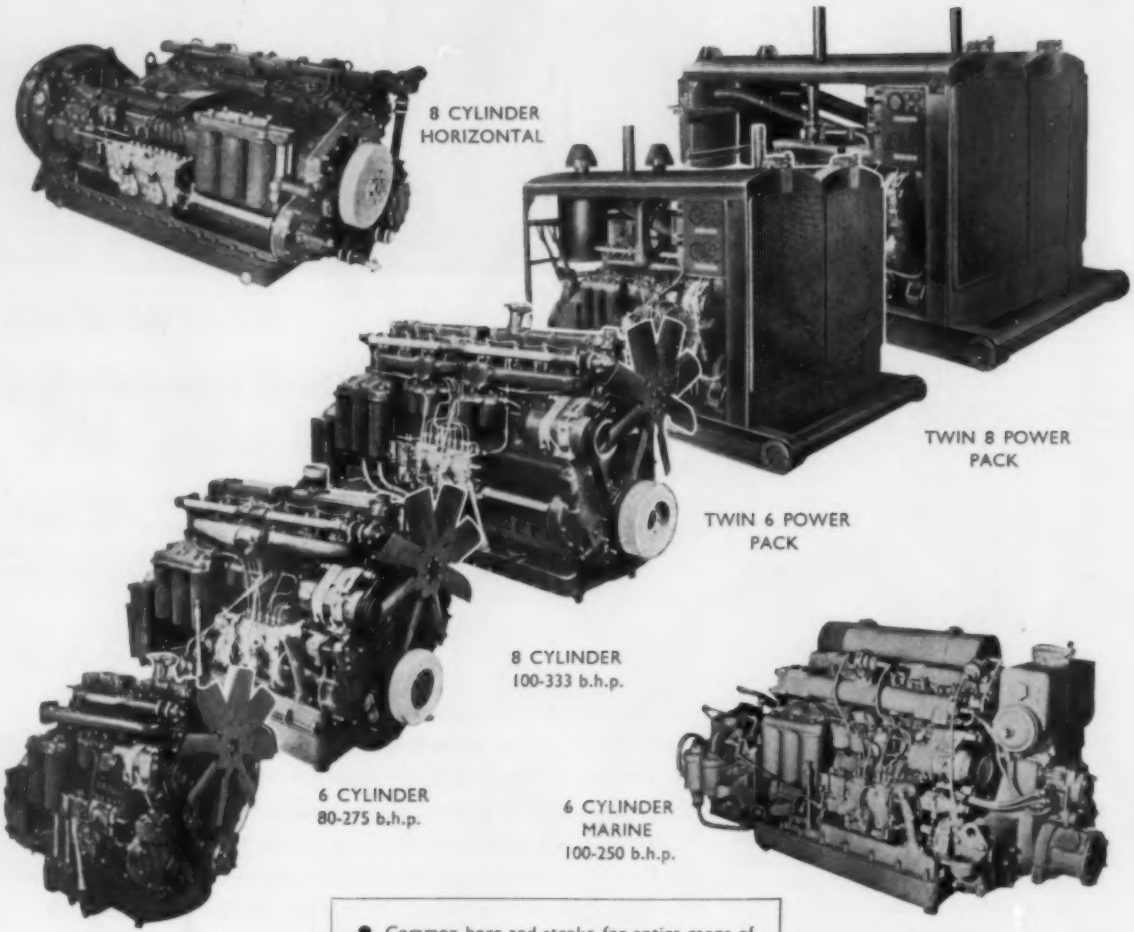
ROLLS-ROYCE

OIL ENGINES



8 CYLINDER HORIZONTAL

TWIN 8 POWER PACK

TWIN 6 POWER PACK

8 CYLINDER 100-333 b.h.p.

6 CYLINDER 80-275 b.h.p.

6 CYLINDER MARINE 100-250 b.h.p.

4 CYLINDER 60-167 b.h.p.

- Common bore and stroke for entire range of four, six and eight cylinder engines
- Spare parts common to all engines
- Right or left hand build, horizontal or vertical

A range of unsupercharged and supercharged 60-600 B.H.P.

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for Automotive, Industrial, Marine and Railway applications

High Speed Personnel Launches — Maracaibo

Woodfield Hoist Drilling Rig — Trinidad

Scammell Constructor — Muscat, Oman

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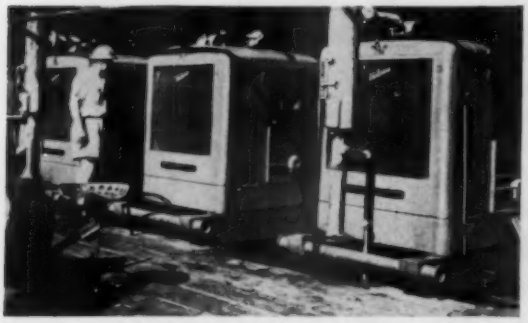

Petbow Generating Set — Seria, Borneo

C.P.T. Air Compressor — Iraq

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OIL ENGINES

ROLLS-ROYCE LIMITED, OIL ENGINE DIVISION, DERBY, ENGLAND

to all NATURAL GASOLINE MEN

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from the

NATURAL GASOLINE SUPPLY MEN'S ASSOCIATION

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THIRTY-SIXTH ANNUAL CONVENTION

of the NATURAL GASOLINE ASSOCIATION OF AMERICA

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The Wickes Boiler Co.
Wilson Supply Company
Woobank Machinery Co.
World Petroleum
Worthington Corporation
Wright Chemical Corporation
Wyatt Metal and Boiler Works

John Zink Burner Company

shipping weights for the various sizes, operation, installation, and other pertinent information on each of the various types of float valves. **Write or call: Golden-Anderson Valve Specialty Co., 1266 Ridge Avenue, Pittsburgh 33, Pa., for Bulletin W-5.**

●

Flexible Controls and Attaching Groups Parts List for various power takeoffs provides general information and illustrations showing how flexible controls are used. It includes a flexible-cable assembly parts list showing sleeve and ratchet types of flexible controls. Other sections of the parts list are devoted to attaching groups for flexible controls for winch clutch and brake control. **Write or call: Braden Winch Co., P. O. Box 547, Broken Arrow, Okla., for a copy of Parts List BFC-5701.**

●

Phasing Units allowing three-phase motors to operate on single-phase power lines are presented in this new four-page bulletin. Describing three models of the phasing units, the bulletin explains the advantages of three-phase operation over single-phase. The advantages listed include the use of three-phase motors, reduction of spare motors carried in stock, and ease of maintenance. **Write or call: T-P Electric & Mfg. Corp., Salem, Ill., for bulletin on phasing units.**

●

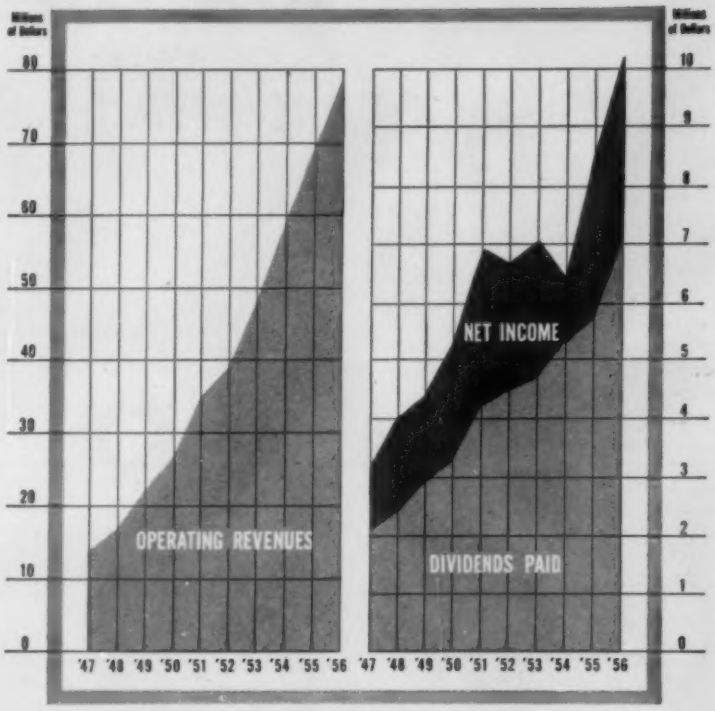
Wall Chart of Conversion Factors furnishes many common conversions such as inches to centimeters or watts to horsepower as well as many conversions that are difficult to locate in reference manuals. Some examples are atmospheres to kilograms per square centimeter, centimeters per second to miles per hour, cubic feet to liters, microns to meters, and quintal to pounds. **Write or call: Precision Equipment Co., 3716 North Milwaukee Avenue, Chicago 41, Ill., for wall chart of conversion factors.**

●

Engines for the World's Oilfields is the title of 20-page Publication 1478. The publication furnishes details on a line of packaged diesel engines available in seven sizes with outputs ranging from 128 to 800 continuous shaft horsepower. Photographs, drawings, curves, and convenient tables furnish information on the engines' construction features, optional equipment, performance, weights, and dimensions. Made in England, the engines find particular use as a power source for drilling rigs and drilling barges. **Write or call: Davey, Paxman & Co., Ltd., Colchester, England, for Publication 1478.**

Southern Natural Gas Company

Our Record for the past ten years



Our Record for 1956

In its Annual Report, Southern Natural Gas advises stockholders that it

- ★ Acquired a majority interest in The Offshore Company, drillers of oil and gas wells specializing in submerged lands off the Gulf Coast
- ★ Made contracts for purchase of gas from fifteen additional gas fields
- ★ Drilled 19 development wells productive of oil or gas
- ★ Increased gas deliveries about 12% over 1955
- ★ Increased the regular dividend payments to an annual rate of $2.00 per share

The Results:

Gross revenues and net income again higher than in any previous calendar year.

	1956	1955
Total Volume of Gas Sold—Mcf	308,307,297	274,851,165
Average Daily Sale—Mcf	842,370	753,017
Gross Revenues	$80,798,930	$69,919,556
Net Income	$10,285,355	$ 8,534,139
Net Income per share	$2.35 (on 4,375,785 shares)	$2.37 (on 3,596,699 shares)
Dividends Paid per share	$1.85	$1.65

SOUTHERN NATURAL GAS COMPANY

For your copy of our 1956 Annual Report, write to Dept. OG

Southern Natural Gas Company

WATTS BUILDING, BIRMINGHAM, ALABAMA

Southern Natural Gas Supplies The Industrial Southeast

EQUIPMENT MEN . . . in the News

McCullough Names Branch Manager, Sales Engineer

M. COYLE

Masterson Coyle, former eastern division fishing tool manager for McCullough Tool Co., has been appointed branch manager at Great Bend, Kans., and Ottis C. King has been transferred from Oklahoma City to Great Bend as sales engineer. These personnel changes were announced by O. J. McCullough, vice president.

Prior to joining McCullough in 1953, Coyle was employed by Humble Oil & Refining Co. and Standard Oil of New Jersey. He has had 36 years' experience in oil fields in the United States, South America and Mexico. King has had 12 years of oil-field experience.

J&L Supply Names Grayson, Crahan to Sales Posts

The appointment of George H. Grayson as city sales representative has been announced by W. L. Wolfe, vice president-sales, Jones & Laughlin Supply Division, Tulsa. Replacing Grayson as field sales representative in the South Texas district is Francis P. (Pat) Crahan.

Prior to becoming a field salesman in 1948, Grayson was a storeman at Brookhaven and Laurel, Miss., where he entered J&L's employ in 1946. Crahan joined the firm's general-products sales department in Tulsa in 1955 and worked at the Beaumont, Tex., and Houston stores before his recent promotion.

Grayson will maintain office headquarters in the district sales office in the Texas National Bank Building. Crahan will operate out of the Houston store.

General Sales Meet Held in Dallas by S. M. Jones

The S. M. Jones Co., manufacturer of sucker rods, held a general sales meeting in Dallas recently. Present were: (seated) R. J. Pauly, secretary-treasurer and controller, Toledo; George H. Ross, Dallas representative; Paul Wolfe, Rocky Mountain representative, Denver; G. E. Flavell, chief engineer, Toledo; W. E. Barfield, Great Bend representative; W. R. Suggs, Shreveport representative; H. F. Bratches, Oklahoma City representative.

Back row: W. H. Ritterbusch, Jr., manager, field engineering department, Tulsa; C. W. Turner, Midland representative; J. B. Frank, Houston representative; W. P. McBee, Wichita Falls representative; Colman Curtiss, vice president, Toledo; M. B. Jones, president, Toledo; L. J. Pundt, general sales manager, Tulsa; Earl Brennan, Brennan-McGary-Robinson Advertising Agency, Houston; and Holt McWorkman, assistant general sales manager, Tulsa.

Reed Roller Bit Appoints Ass't. to Advertising Mgr.

Daniel H. Reat has joined Reed Roller Bit Co. of Houston as assistant to the advertising manager. Previously he was advertising manager of Bowen-Itco, Houston oil-tool firm.

Sperry-Sun Annual Sales Meeting Held in Houston

Executives and sales representatives for Sperry-Sun Well Surveying Co. gathered in Houston recently from western United States, Canada, and Texas for the company's annual sales meeting. Attending the meeting were: (front row) Stephen W. Gurasich, Houston; W. R. Angelle, Jr., Lafayette; Charles C. Littlefield, Jr., Odessa; Edward J. Blackburn and Fred S. Kielman, Jr., Houston.

Second row: A. B. Palmer, general manager, Houston; Quentin B. Marsh, Houston; John B. Peddy, Oklahoma City; H. A. Wesner, Houston; Harry M. Lowe, Long Beach; W. B. McElreath, Beaumont; Gilbert J. Butterworth, Houston; John V. Evans, Wichita Falls.

Back row: S. H. Williston, vice president; Donald R. Hering, Long Beach, Calif.; Roland D. Warden, Casper, Wyo.; J. I. Murph, Corpus Christi; R. R. Blakeley, Odessa; John S. Gosling, Edmonton, Canada; Alton J. Goolsbee, Marshall; Charles E. Hawk, Houston.

Lane-Wells Announces Personnel Changes

E. T. Robertson, area manager at Magnolia, Ark., has been reclassified to assistant district manager of Lane-Wells Co.'s Arklatex district and transferred to Shreveport, La.

N. S. Kimball, Jr., field service operator in Hobbs, N. M., has been reclassified to district sales engineer trainee and transferred to Alice, Tex. E. H. Peveto has been reclassified from district logging engineer to district logging and mechanical engineer with headquarters at Alice.

W. E. Johnson has been designated field service operator in charge of the Cisco, Tex., truck station.

R. E. Jordan, senior division mechanical engineer, Houston, was transferred to head office engineering department in Los Angeles. R. B. Reynaud, district mechanical engineer at Harvey,

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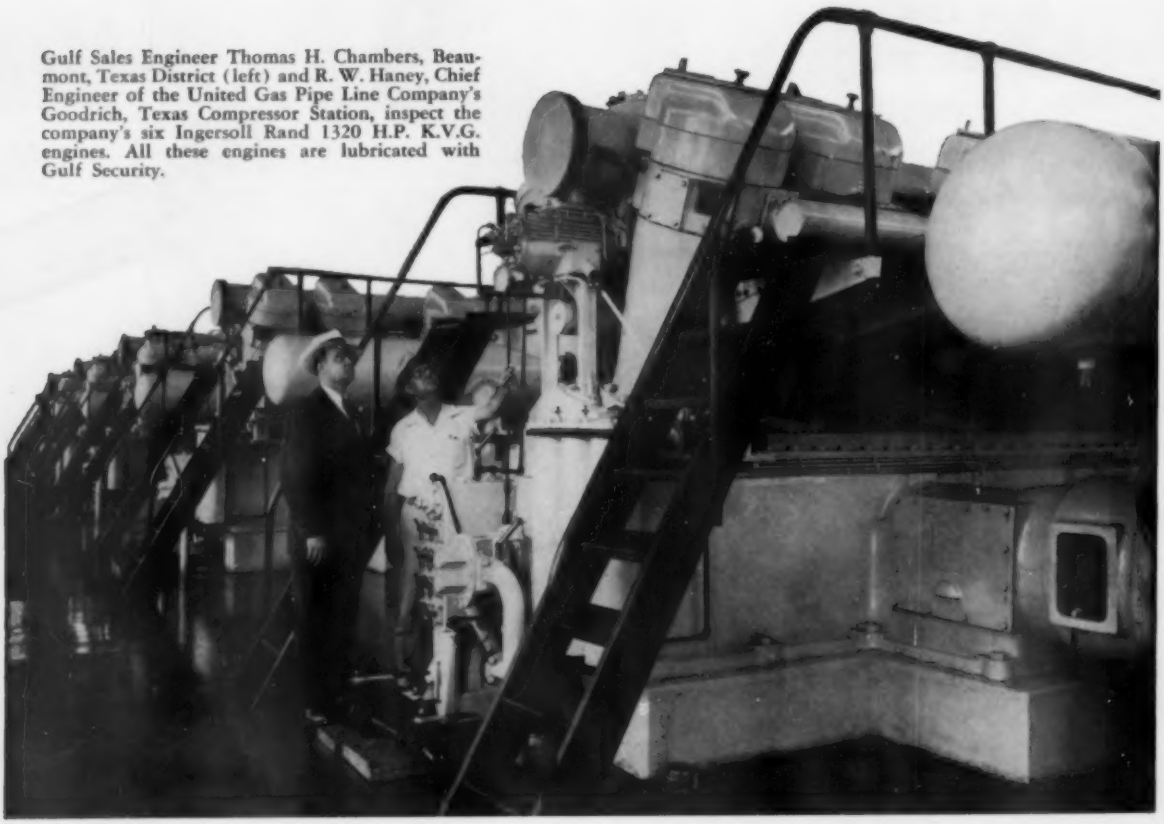

Gulf Sales Engineer Thomas H. Chambers, Beaumont, Texas District (left) and R. W. Haney, Chief Engineer of the United Gas Pipe Line Company's Goodrich, Texas Compressor Station, inspect the company's six Ingersoll Rand 1320 H.P. K.V.G. engines. All these engines are lubricated with Gulf Security.

Lock out high maintenance costs in your gas transmission plants

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Gulf Security's outstanding record in the lubrication of pipeline gas engine compressor units is your assurance of smooth, continuous operation. In scores of gas transmission plants this high quality straight mineral oil helps prevent operating troubles and contributes to low maintenance costs.

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Make certain your units receive safe, effective lubrication protection—specify Gulf Security. And remember that Gulf provides the services of a trained, experienced petroleum expert—the Gulf Sales Engineer—to help you with any problem involving a petroleum product. Consult the telephone directory for the number of your nearest Gulf office.

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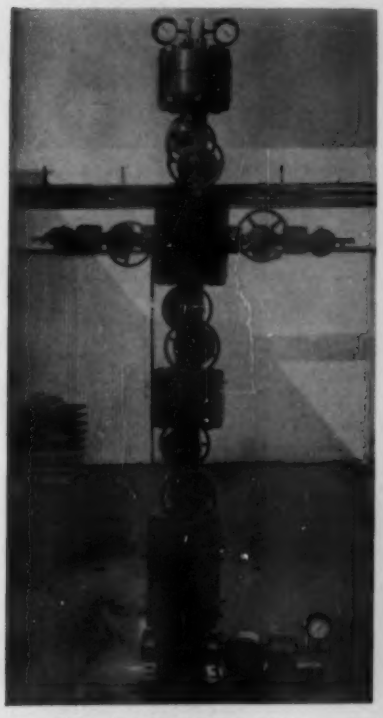
La., was transferred to Houston as senior division mechanical engineer. P. A. Pausky, division mechanical engineer in Houston was transferred to head office engineering department, Los Angeles.

Walworth Names Jackson As Sales Vice President

Frederick M. Jackson has been named vice president in charge of sales for Walworth Co., Fred W. Belz, president, has announced. Jackson joined Walworth in 1926, becoming eastern divisional sales manager in 1940, and vice president for oil and gas industry sales in 1952.

OCT Delivers Giant Tree To Louisiana Offshore Rig



A giant dual-completion christmas tree manufactured by Oil Center Tool Co. of Houston, one with a height of 18 ft. excluding its casing heads that was tested for 15,000 psi., has been installed on a discovery well in the Gulf of Mexico offshore from Cameron Parish, Louisiana.

Natural Gas & Oil Co., a division of Mississippi River Fuel Corp., and Ocean Drilling & Exploration Co., announced the dual completion of the well, the State Lease 1172 No. 1, as a gas-distillate wildcat producer.

Drilled in the East Cameron area, the well unofficially tested 3.3 million cubic feet of gas and 41 barrels of 44.6 gravity distillate on a 10/64-in. choke daily in the lower zone, perforated between 13,056-13,120 ft. Upper zone flow, perforated between 12,902-20 ft., tested 3.1 million cubic feet of gas and 36 bbl. of 46.3°-gravity distillate daily.

Independent Exploration Promotes E. I. Grizzell

E. I. GRIZZELL

E. I. Grizzell has been promoted to the job of supervisor by Independent Exploration Co., according to T. I. (Pop) Harkins, president.

Grizzell previously served in the technical jobs of surveyor, observer, computer, and party chief. In his new work, he will be responsible for the interpretation of seismic data and the over-all operations of field crews. Grizzell had been with Independent Exploration 20 years. Of this time 8 years were spent in Independent Exploration's foreign operations in the Middle East, South America, and the West Indies.

Oilwell Opens Farmington Store, Realigns Districts

The opening of a new branch store at Farmington, N. M., by United States Steel Corp.'s Oil Well Supply Division

has been announced by K. B. Winstead, assistant vice president-sales of the division.

The new store and a realignment of regional responsibility are for the purpose of providing field and store service in the Four Corners region.

Counties in northwestern New Mexico to be transferred from the Central Midwest area to the Rocky Mountain area include San Juan, Rio Arriba, McKinley, Sandoval, Los Alamos, Santa Fe, Valencia, and Bernalillo. Apache County in northeastern Arizona will be transferred from the California area to the Rocky Mountain area.

Hughes Tool Names Aulick, Willis to Engineer Posts

R. R. AULICK

J. G. WILLIS

Appointment of R. R. Aulick as regional engineer for Hughes Tool Co. has been announced by M. E. Montrose, vice president-sales. Naming of John G. Willis as division engineer has been announced by W. L. Hunter, manager of the northern region. Both men will be headquartered in Oklahoma City.

Aulick, who has been with Hughes since 1947, was previously division engineer for Oklahoma-Kansas and acting regional engineer. Willis, with Hughes since 1949, was previously district engineer.

United's New Outlet Serves Louisiana Gulf Coast Area

United Supply & Manufacturing Co. of Tulsa has broadened its services to the Louisiana Gulf Coast with a new store at Grand Isle, La., Brooks Gutelius, Jr., president, has announced.

O. L. Short, who has served United at Oklahoma City, Odessa and Alice, Tex., and Harvey, La., during his 6 years with the company, has been named manager of the new store. The new outlet is the company's twenty-second.

The new location is under the supervision of Jack Blalock, United's district manager in New Orleans.

BS&B Oil Field Equipment Division Names Managers

JOHN WILLIAMS

JOE BEGGS

Promotion of John Williams and Joe Beggs has been announced by Floyd C. Myers, manager of sales and service, oil-field equipment division of Black, Sivalls & Bryson, Inc. Williams has been named manager of the Denver oil-field district, and Beggs is manager of a newly created sales district which includes the Four Corners area of New Mexico, Arizona, Utah, and Colorado. Headquarters for the new district will be at Farmington.

Williams succeeds C. D. (Dee) Unsell, who has been with the company 20 years, the last 10 as manager of the Denver district. Unsell will continue his association with BS&B as a special representative in the Denver vicinity.

Williams has been with BS&B for the past 8 years at Graham and Alice, Tex., and Casper, Wyo., as branch manager and district engineer. Beggs, who has been with BS&B since 1926, has been manager of the company's

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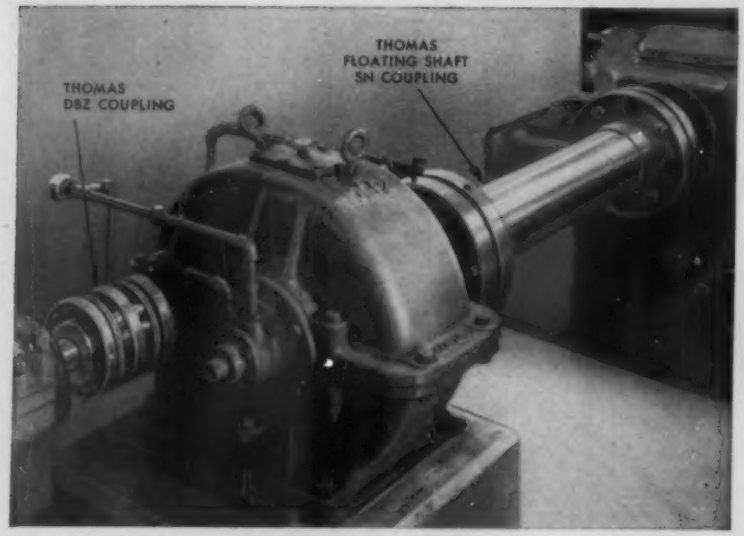

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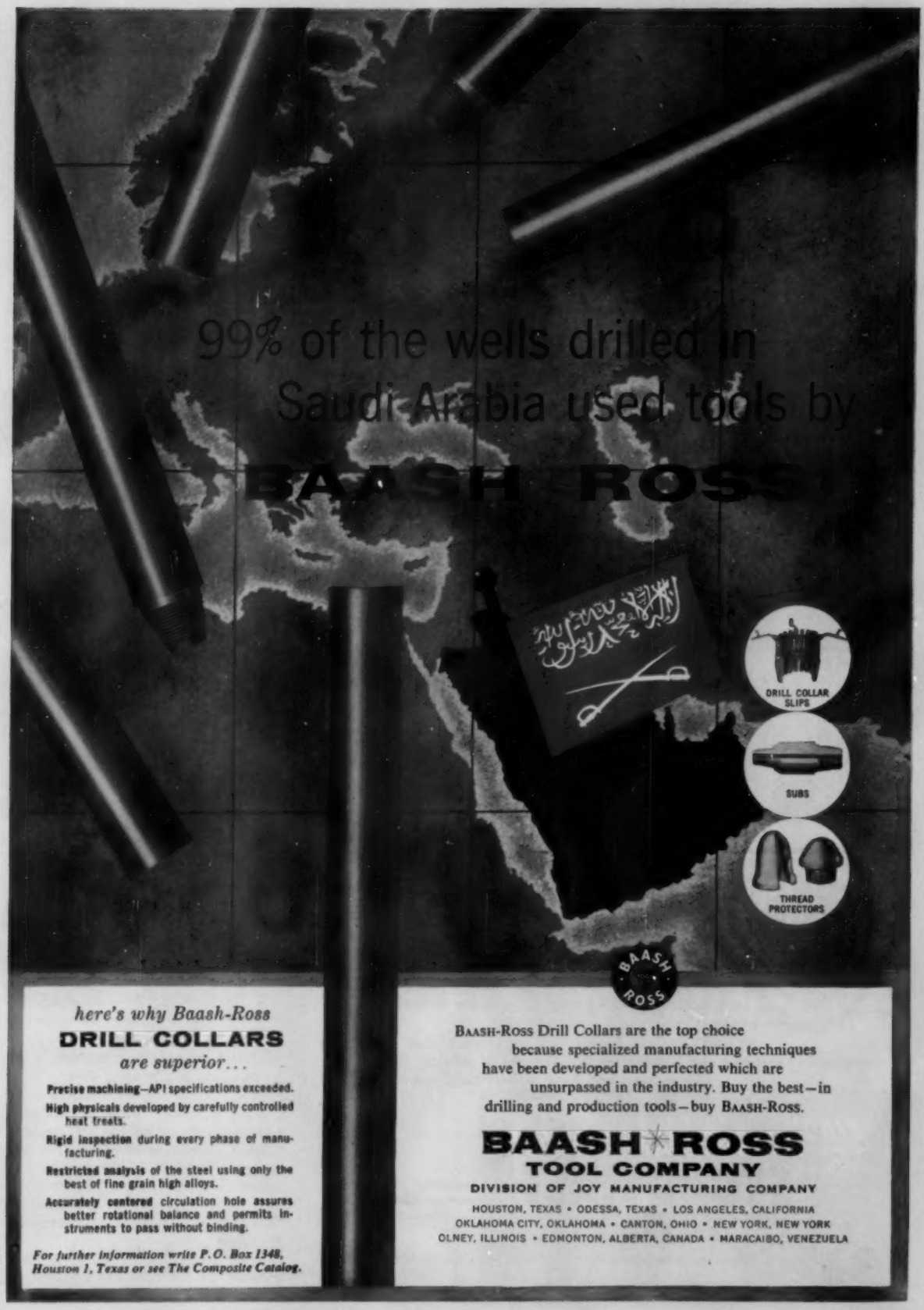

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Farmington, N. M., branch for the past 6 years. Previously, he had been salesman and branch manager at several points in Kansas.

Jet-Lube Names Courtney For Oklahoma, Nebraska

O. J. (Jay) Courtney, Oklahoma City, has been appointed as representative of Jet-Lube oil-field thread compounds and specialized lubricants for the states of Oklahoma and Nebraska, it has been announced by Joe Bergeron, vice president and general sales manager of Jet-Lube, Inc., Burbank, Calif.

Jet-Lube tool-joint compounds and specialty lubricants are sold exclusively through supply houses.

Welex Names Dunford and Cross as Sales Engineers

R. P. Dunford and Jack B. Cross have been named sales engineers for Welex Jet Services, Inc., Fort Worth. Dunford became a sales engineer in the company's Stillwater, Okla., district after more than 6 years with the company in various field jobs.

Cross was named sales engineer for the Wichita Falls, Tex., district.

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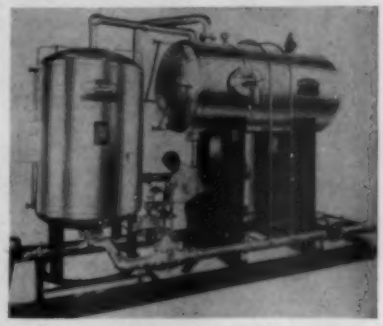
Oil Metering & Processing Sends Unit to Middle East



A large three-phase separator and metering vessel combination has been constructed by Oil Metering & Processing Equipment Corp. of Houston for use in the Middle East.

Destined for Arabia, the separating and metering unit weighs 5 tons. It is the largest standard model well tester the oil-equipment firm manufacturers. The unit is mounted on a skid 6 ft. wide and 18 ft. long. It is 11 ft. high. The unit is completely assembled for ready hook-up to inlet and outlet lines. It is equipped with 4-in. connecting lines.

Capable of measuring 4,000 barrels of oil per day, the well tester's metering unit, a 100 CV Vol-U-Meter, measures 10 barrels per dump.

Johnston Testers Names Sales-Advertising Manager

PHIL GRIFFIN

Phil Griffin has been named manager of sales and advertising for Johnson Testers, Inc., with headquarters in Houston, D. C. McCann, president, has announced. Griffin replaces J. E. Smith who resigned recently to become president of Hutchison Manufacturing Co., Houston.

Griffin has been assistant sales manager for 3 years, being transferred to Houston in 1955. He has been with the company 6 years and was in engineering and sales work in the Dallas-Fort Worth area before his transfer to Houston.

Alcoa's West Is Elected A Director of N.A.C.E.

John B. West, district development engineer, Aluminum Co. of America's Atlanta district sales office, has been elected a director of the National Association of Corrosion Engineers. He took office March 15, the final day of this year's N.A.C.E. conference in St. Louis.

West joined Alcoa in 1936. As a member of the company's jobbing division, he was active in the develop-

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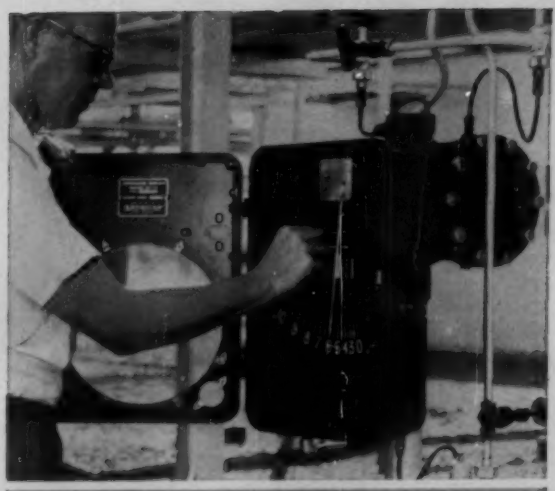

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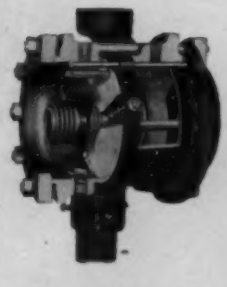
Above, an American DRI-FLO Meter is used to measure ethane reflux flow on a de-ethanizer unit in a gasoline plant at 500 psi and 80 to 100° F, typical of one of the many installations meeting the most exacting requirements.

Below, a DRI-FLO manometer is shown measuring lease gas and is used in conjunction with a 30-year-old recording mechanism — proof of the versatility and long service life built into American products.



DRI-FLO Meters bring American-Westcott precision, simplicity of installation and maintenance, with maximum resistance to corrosive materials, to orifice meter measurement. Differential ranges: 20", 50", 100", and 200"; Working pressures 1000 and 5000 psi; Ambient temperatures of –25 to 175°F.

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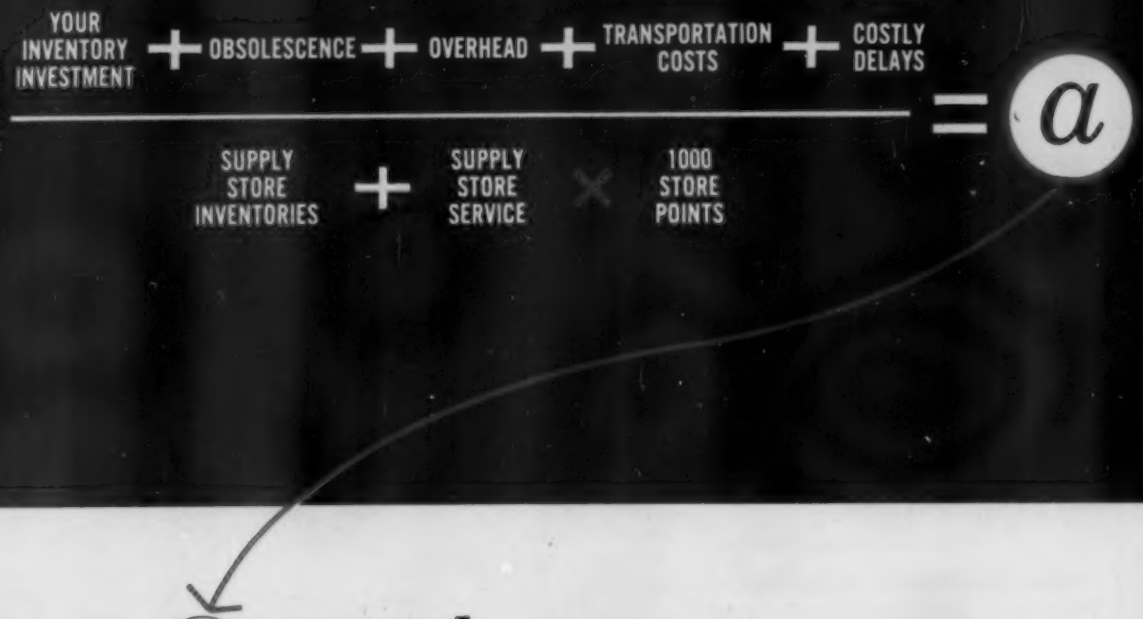

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LARKIN LEADERSHIP HAS BEEN EARNED BY YEARS OF DEPENDABLE PERFORMANCE

ment of fabricating procedures and products for magnesium alloys. He was named assistant chief engineer of Alcoa's jobbing division in 1944 and assumed his present position in 1945.

Tullis Named Director in New Board at J. B. Beaird

J. L. TULLIS

John L. Tullis, vice president in charge of sales, and five officials of American Machine & Foundry Co., have been added as members of a newly formed board of directors of The J. B. Beaird Co., Inc., Shreveport, La., J. Pat Beaird, president, has announced. Election of the new directors at a board meeting in New York City recently follows the recent merger of Beaird and AMF.

Tullis, the new Beaird member of the board, has been with Beaird 10 years and was named vice president in charge of sales in 1954. Rounding out the nine-member board are J. Pat Beaird, president and general manager of Beaird; J. G. O'Brien, vice president and treasurer, Beaird; Charles T. Beaird; Morehead Patterson, chairman of the board and president of AMF; Rodney C. Gott, AMF executive vice president; Robert W. Kerr, AMF vice president; Dave S. Meiklejohn, AMF treasurer; and M. G. McCool, president of American Iron & Machine Works, Oklahoma City, an AMF affiliate. J. Pat Beaird was also named a director of American Iron & Machine Works at the same meeting.

Los Angeles Nomads Induct Three New Members

Induction ceremonies at a recent meeting of the Los Angeles Chapter of Nomads were conducted for three new members. Shown are Bill Brooks, Byron Jackson Tools, Inc., ritual master; George Ruppert, The Oil and Gas Journal; Herb Klepfer, Baash-Ross Tool Co.; and Hilmer Olson, S. R. Bowen Co., inductees; Ox Morgan, Falcon Products, Inc., of the ritual committee.

Perforating Guns Atlas Holds Management Conference

Paul Charrin, president of Perforating Guns Atlas Corp., told the company's key management men attending the recent 2-day management conference at Houston that PGAC's business in 1956 increased 22.5 per cent.

The conference was attended by Dr. Hans Nielsen, manager of PAGC's subsidiary, Atlas Deutsch-Amerikanische Oldeldienst G.m.b.H., who came from Kiel, Germany. W. A. McKay, general manager of PGAC's Canadian subsidiary, Perforating Guns of Canada, Ltd., came from Edmonton, Alta., to attend the conference.

Operations procedures were reviewed and plans completed for the company's 1957 expansion program. Solutions were devised for the problem of securing and training the many experienced technicians needed to serve the demand for PGAC's logging and perforating services in this country, Germany, and Venezuela.

Seated: Jake LeBus, chief engineer; J. H. Russell, operations manager; Dr. Hans Nielsen, manager, Atlas Deutsch-Amerikanische Oldeidienst, G.m.b.H.; Paul Charrin, president; W. A. McKay, manager, Perforating Guns of Canada, Ltd.; J. H. Castel, executive vice president; Cecil C. Hinson, administrative assistant.

Middle row: H. Clay Waters, manager, electrical logging department; E. A. White, station manager, Pampa, Tex.; Jack Henley, district manager, Odessa, Tex.; Harry Hacke, superintendent of operations; Jack Howse, district manager, Oklahoma City; J. Floyd Taylor, district manager of southern Louisiana; W. R. Rabson, manager, radiation logging department; Rush George, district manager, Wichita Falls, Tex.

Back row: G. Al Grissom, station manager, Victoria, Tex.; Cecil Clark, district superintendent, Houston; J. P. McHenry, station manager, Beaumont, Tex.; Al Kangers, district manager, Great Bend, Kans.; R. M. Haynie, station manager, Greggton, Tex.; John Rhodes, assistant district manager, Odessa; and George Decker, district manager, Alice, Tex.

Carley Tours Europe, Asia To See Failing Rig Users

Everett P. Carley, chief engineer for George E. Failing Co. of Enid, Okla., manufacturers of portable rotary drilling rigs, is on a trip through Europe and Asia. Carley's itinerary calls for visits to users of Failing rigs in Holland, Saudi Arabia, Turkey, France, Germany, Belgium, and England.

Midwestern to Distribute Pittsburgh Coke Coatings

Midwestern Pipe Line Products Co. of Tulsa has been appointed as distributor of Pitt Chem cold-applied tar coatings and Tarset in the Oklahoma, Kansas, and Kansas City, Mo., territories, for Pittsburgh Coke & Chemical Co., Pittsburgh, Pa.

Midwestern is a leading supplier of pipe wrapping, coating and other protective materials, representing such companies as Keystone Roofing Co., Owens-Corning, Presstite Keystone Engineering Co., Twinsburg-Miller Corp., Kerr-McGee Oil Industries, in addition to Pittsburgh Coke & Chemical Co.

Ask the operators who have seen it! Field Laboratory No. 56 is the finest combination package of well logging and core analysis equipment ever put into commercial service — *to pinpoint stray pays, pick proper coring points at major objectives, and to plan completions with accurately measured data.*

First to be finished in a fleet of new skid-type, portable laboratories, FL-56 represents a concentrated effort by Core Lab's Research and Development Department. Coordinating eighteen months of detailed testing and design with the experience of on-location personnel, these units carry virtually every known aid proven to be "field practical" in the continuous analysis of mud and cuttings during drilling operations.

Among its many scientific refinements and innovations, FL-56 features a new super-sensitive gas trap, modified gas detector circuits for greater stability and range, pump stroke counters, pump rate meter, a mud pit level instrument, and total depth and "off-bottom" counters. In addition to other standard well logging devices, four strip chart recorders are used to provide continuous records of gas in the mud, drilling rate as a bar graph, direct measurement of weight on the bit, and pump pressure.

And, for the comfort and convenience of technicians and clients, each unit is air-conditioned by refrigeration and equipped with a modern, multi-station intercom system.

Technical and financial stability gives Core Lab the opportunity to maintain a Research and Development program which, in turn, provides the entire industry with better tools for use in its search for and recovery of new oil.

Like to see a color photo showing the interior details of these new logging units? Mail request on your company letterhead to address below. Please mention this publication.

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"Forgotten Corner" Finds A New Target

by Frank J. Gardner

DISCOVERY OF OIL at 1 Bugbee, Glacier County, Montana, may renew interest in the deeper-pay objectives of the Sweetgrass arch.

ON April 30, 1956, the Journal printed an article entitled "Sweetgrass Arch . . . Forgotten Corner of the Rockies." In it, Author Ed Gribi, Jr., tried to call industry attention to the great possibilities of undiscovered oil in northwestern Montana. Reading it, one felt tempted to take the next train to Great Falls and start a drilling campaign.

But in all of 1956, not one successful wildcat was drilled in the area of today's map. As a matter of fact, only 14 wildcats went down at all, and the deepest of these went to 4,634 ft., where it stopped in Cambrian. One, in the Disturbed Belt, reached 7,853 ft.

A neglected arch . . . But for some reason, operators continue to neglect the Sweetgrass arch country, and few areas today offer better prospects for strat traps at shallow depths. This massive, gently plunging anticline has its roots in the Belt Mountains south of Great Falls, and dies out in southern Alberta; it dips to the east into the Williston basin with few interruptions; to the west, it disappears in the thrust-fault complex of the Disturbed Belt. Along its flanks, prolific oil fields were found as early as 1922 at Kevin-Sunburst. Later finds at Cut Bank, Pondera, and Reagan confirmed the region as a major source of oil.

Most production to date has come from shallow sands of Cretaceous and Jurassic age, and from the upper Madison - Mississippian group (Sun River dolomite). Very few tests have probed deeper than Mission Canyon.

Makes important news . . . This week, an independent oil company supplied the Sweetgrass country with important exploration news. Flank Oil Co., of Billings, Mont., announced successful completion tests in its 1 Bugbee, Section 6-33n-6w, in Glacier County, only 4 miles west of Cut Bank field. It is important because it is the first well in this part of the state to produce commercial oil from the Lodgepole-Lower Mississippian section. It adds an entirely new reservoir target for northwestern Montana operations.

Flank Oil, a wholly owned subsidiary of New British Dominion Oil Co., Ltd., of Calgary, undertook the drilling of 1 Bugbee in conjunction with United States Smelting, Mining & Refining Co. Waggoner-Lansford Drilling Co. held the drilling contract and some interest in the well.

Discovery at Bugbee was made in an 11-ft. fractured limestone zone of basal Lodgepole. Cores revealed fracturing from 4,629-40 ft. with good oil staining throughout, and on a drillstem test at 4,625-43 ft., gas was at the surface in 2 minutes, and in 23 minutes clean, green 36°-gravity oil flowed at a rate of 25 bbl. in 1 hour. Successful completion at this level will give the Sweetgrass arch flank a new objective and should stimulate a lot of new drilling in the four counties shown here.

Only ¾ mile southeast of this new discovery, Union Oil Co. of California and Carter Oil Co. had a 1954 failure, the 1 Tribal 470; this well also found oil on tests of the same interval, and actually produced for a time at a rate of 516 bbl. per day on initial tests of Madison, but it finally was abandoned because of mechanical difficulties. Flank Oil Co. therefore has reason to believe that it has tapped a reservoir of considerable areal extent.

In a forgotten corner . . . The regional unconformity at the top of the Mississippian on the flanks and at the crest of Sweetgrass arch has accounted for the stratigraphic fields so far found; it reminds one very much of the trapping conditions now paying off so handsomely in southeastern Saskatchewan. But little attention has been paid to the deeper horizons of Lower Mississippian and Devonian age, where a multitude of oil shows have been found. Perhaps this new strike will help direct more exploratory attention to this forgotten corner of the Rockies.

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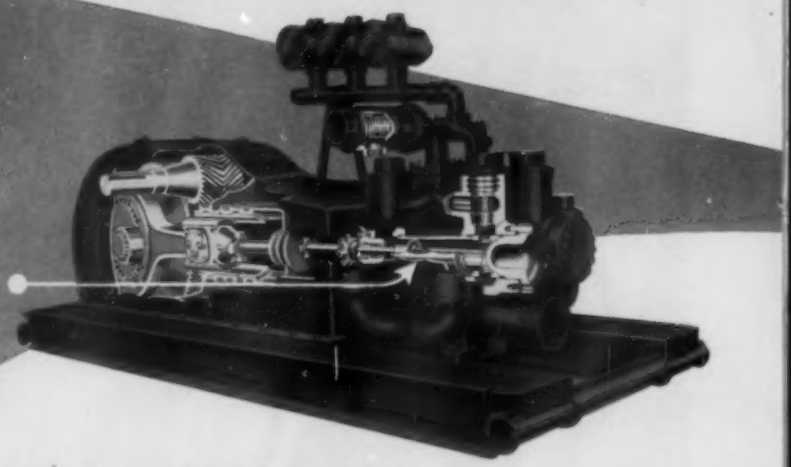

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Noelke Reef Lures Oil Finders to Irion County

● Here is the story of how the Noelke discovery pushed Irion County to the forefront in 1956.

by A. P. Wishart, W. E. Hall, and C. S. Hill

NOELKE REEF is located in southeastern Irion County in semiarid Southwest Texas. Fig. 1.

THE Noelke reef is in southeastern Irion County in the semiarid grazing country of Southwest Texas, Fig. 1. Many geologists consider the Noelke reef, now known as Sixty-Seven field, to be the most important discovery in the county. The reef is of upper Strawn (Des Moines) age, and is like many well-known producing reefs in the general area. The field was opened in 1956 by British-American Oil Producing Co. on a farmout from Atlantic Refining Co.

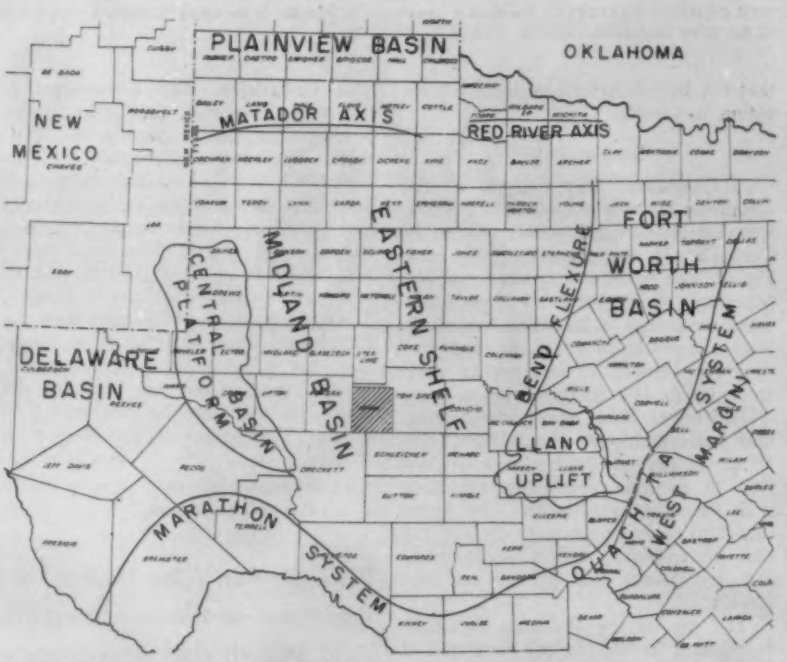
Oil was discovered in Irion County in 1928, but exploration activity was slight from 1928 until 1955. An increase in exploration activity during 1955 resulted in the drilling of 16 wells. Of these, 14 were wildcats which opened five new fields. During the first 11 months of 1956, 21 of the 63 wells drilled in the county were completed as discoveries or field extensions, from pays ranging in age from San Angelo, through upper Clear Fork and Wolfcamp to Strawn. Discoveries and lease expirations in 1956 caused the highest level of exploration activity experienced in the county.

Geologic history . . . Geologic history concerning the Noelke reef begins during the Ordovician. Near the beginning of Simpson time the nearly flat surface of the Ellenburger was folded into large basin areas. One of these basins was the Ancestral Permian basin which occupied the general area of the upper Paleozoic Delaware, Val Verde and Midland basins, Fig. 2. Irion County, on the eastern shore of this old basin, was exposed to subaerial erosion during the remainder of the Ordovician, all the Silurian and Devonian, and part of the Mississippian. During this time the Ellenburger was greatly reduced in thickness. The Mississippian transgression which followed apparently had little influence on sedimentation in the Irion County area.

Tectonic movements during early Pennsylvanian time affected the general area, and new basins were formed which dominated the topography until middle Permian time. The Noelke structure locality was folded and denudation may have been renewed. Carbonate sedimentation was renewed during Strawn time and carbonate platforms were built on shelves throughout the general area. It was on such a carbonate platform that rapid reef growth was initiated on the Noelke structure during late Strawn time.

Widespread deformation near the beginning of Wolfcamp time caused an influx of fine clastics to the area, the deep basins were filled and some shelf areas, including Noelke, were buried. Small faults may have occurred at this time. Structure mapping on the top of the Wolfcamp, and also younger Permian, gently reflects the underlying fold at Noelke, and shows that later folding affected the area.

Discovery history . . . Early investment by Atlantic Refining Co. in the Noelke reef area was based on subsurface geology and shows of oil. Later, structural interpretations of seimic data showed the area to be anomalous and, more recently, seismic interpretations clearly indicated a closed structure. It was on recent seismic structural interpretation



TECTONIC MAP of Texas shows how Irion County, Texas was exposed to subaerial erosion reducing the Ellenburger in thickness. Fig. 2.

Authors are with Atlantic Refining Co. This paper was presented under the title, "The Noelke Reef in Irion County, Texas," at the Fifth Biennial Symposium on Subsurface Geology held at the University of Oklahoma in Norman, March 12-13, 1957. This paper along with the other papers presented at the symposium will be available in the proceedings of the conference at an early date.

GENERALIZED STRATIGRAPHIC CHART
IRION COUNTY, TEXAS
NOELKE AREA

ERA	PERIOD	SERIES	GROUPS AND FORMATIONS, ETC.
PALEOZOIC	PERMIAN	OCHOA	
		GUADALUPE	SAN ANDRES (SAN ANGELO)
		LEONARD	CLEAR FORK SPRABERRY
		WOLFCAMP	HUECO (DEAN) BURSUM
	PENNSYLVANIAN	VIRGIL	CISCO
		MISSOURI	CANYON
		DES MOINES	STRAWN
		ATOKA	
		MORROW	
	MISSISSIPPIAN	?	
	DEVONIAN		
	SILURIAN		
	ORDOVICIAN	CANADIAN	ELLENBURGER
	CAMBRIAN	UPPER CAMBRIAN	WILBERNS RILEY

THE OLDEST CAMBRIAN formation penetrated at Noelke is an upper Cambrian sandstone of the Riley formation. Fig. 3.

that the British-American discovery location was made.

Stratigraphy

... Cambrian. The margin of the Cambrian sea was not far to the northwest of Noelke and a full section of Cambrian is not present in the area, Fig. 3. The oldest Cambrian formation penetrated at Noelke is an upper Cambrian sandstone of the Riley formation. It is a medium to coarse-grained gray to green glauconitic and pyritic sandstone up to 400 ft. in thickness.

The upper Riley sandstone is overlain conformably by the Wilberns. In Irion County the Wilberns is a gray, fine to medium crystalline limestone with abundant glauconite. The upper one-third is sometimes very shaly. Gray and greenish-gray shales predominate but red shales are present as thin streaks.

The top of the Wilberns limestone is missing in the British-American 1 Noelke owing to local truncation during early Pennsylvanian time.

... Ordovician. The Ellenburger is the only Ordovician formation in the Noelke area and it overlies the Wilberns limestone conformably. Lithologically it is a fine to medium crystalline, gray to tan dolomite. It is cherty and contains some coarse rounded frosted sand grains. The local thickness varies from 50 to 200 ft., but in one well, British-American 1 Noelke, it is entirely removed. Farther west the Ellenburger exceeds 1,500 ft. in thickness, but it thins regionally eastward. This picture of thinning leads to the conclusion that only the lowermost part of the Ellenburger is represented at Noelke.

... Silurian—absent.

... Devonian—absent.

... Mississippian—absent. Some upper Mississippian may have been removed by erosion from the Noelke area.

... Pennsylvanian. The Strawn (Des Moines) was deposited as a shelf type of limestone on the truncated Ellenburger surface in Irion County. Its thickness varies from 50 to 150 ft. It is composed of tan to brown, dense to fine, crystalline limestone and may contain some brown to gray chert. Strawn reef limestone, which was discovered in British-American 1 Noelke, rests on this Strawn shelf type of limestone.

The reef limestone is white to tan, highly fossilferous, and is medium to coarsely crystalline. In the discovery well, 263 ft. of reef limestone is present. The reef has vuggy and pin-point porosity in the upper part and its age is determined by index fossils such as Fusulina. In the locality of the reef, and the associated structural fold, the underlying shelf limestone is much thicker than elsewhere. The greater thickness resulted from local conditions associated with a depth of water which was more favorable to rapid carbonate sedimentation.

The upper Pennsylvanian Canyon (Missouri) and Cisco (Virgil) are thin in Irion County, probably not exceeding 300 ft. in thickness. Together they are composed of fine to medium-grained well-indurated sandstones and dark gray shale with some thin beds of brown dense to fine crystalline limestone. These beds apparently abutted the Noelke reef, but did not cover it.

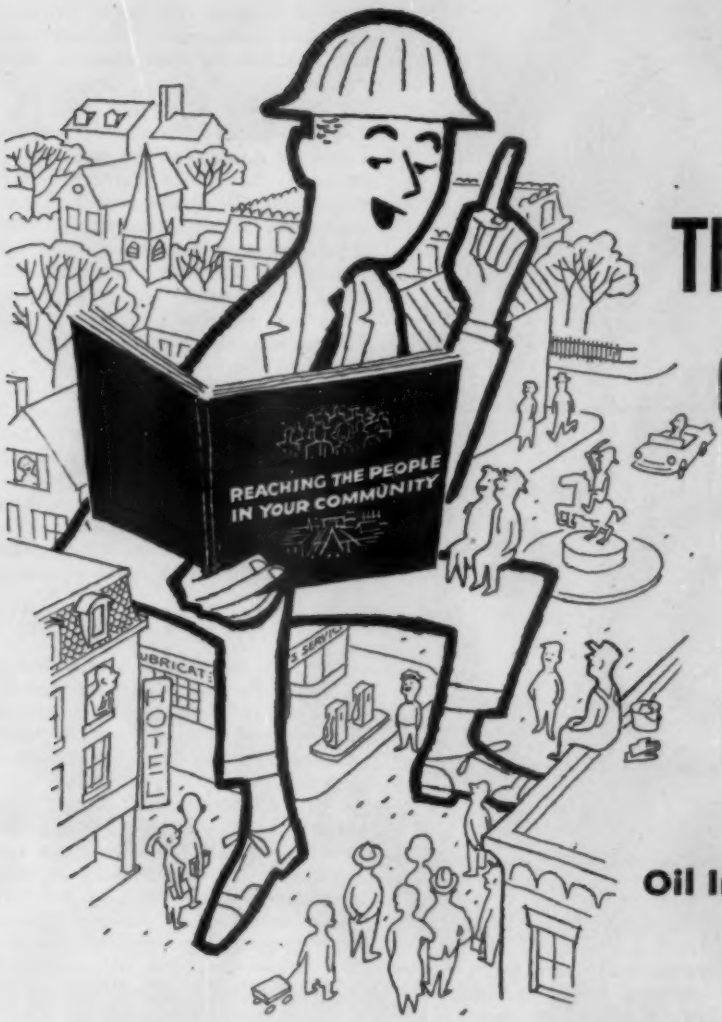
... Permian. The Wolfcamp, of lower Permian age, ranges from 1,800 to more than 2,600 ft. in thickness in the Noelke area. The lower Wolfcamp consists of dark gray shales, siltstones and fine-grained sandstones, and also a few dense gray to brown thin bedded limestones. The upper Wolfcamp contains more limestones, some of which are quite massive. The Dean siltstone occurring near the top of the Wolfcamp is fine grained, well cemented and has little porosity.

Structure

Fig. 4 (Ellenburger structure) is contoured on the surface of the Ellenburger. It shows post-Ellenburger structure, but shows only a general picture of folding in the Ellenburger.

Fig. 5 is a cross-section through the reef discovery well. It shows the reef

"The Strawn (Des Moines) was deposited as a shelf type of limestone on the truncated Ellenburger surface in Irion County . . . Strawn reef limestone, which was discovered in British-American 1 Noelke, rests on this Strawn shelf type limestone."



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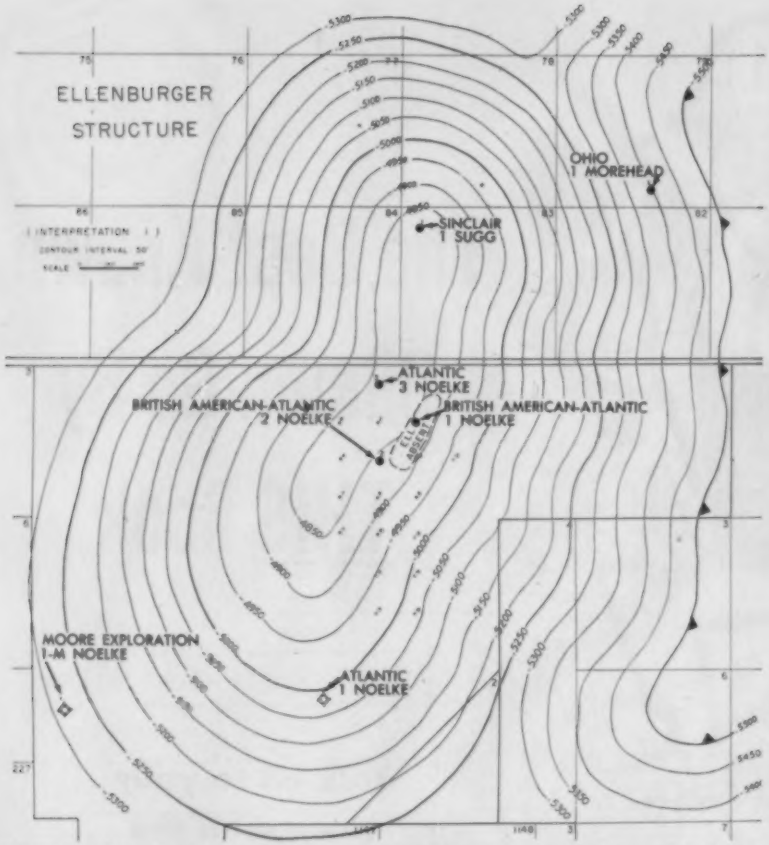


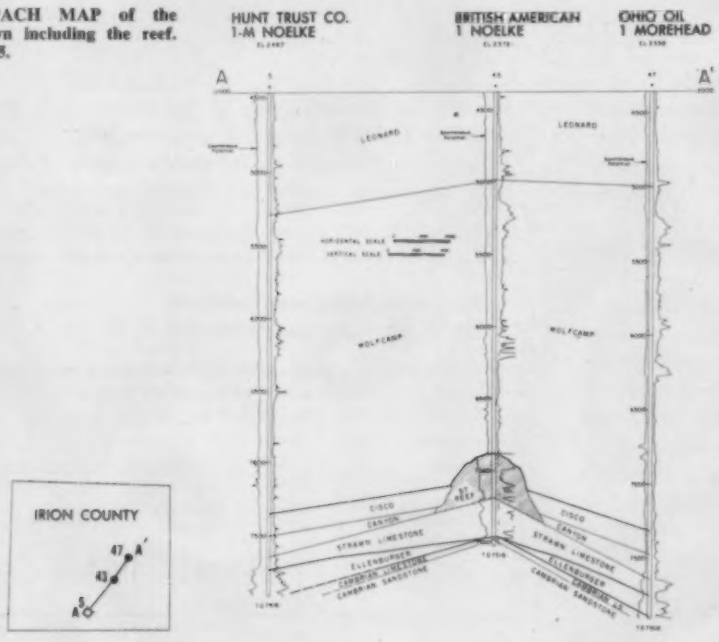
CONTOUR MAP showing the Ellenburger structure but only a general picture of folding in the Ellenburger. Fig. 4.

and also truncation of the pre-Strawn.

Folding of the Pennsylvanian is best shown by structure contours on the surface of the upper Strawn bedded limestone, Fig. 6. The present regional dip, which is less than 1° to the west, is a composite of several major changes. The principal influence which it reflects is probably the upper Permian salt basin subsidence. This basin was also modified by later changes; particularly by Gulf Coast subsidence to the southeast of about 1°.

The principal movement which affected the structure of the Noelke area occurred during the early Pennsylvanian, Fig. 3. At this time the Llano region to the east was uplifted, the Bend arch to the northeast started its history, the Marathon folding was initiated to the south, and the Midland basin area subsided to the west. The Noelke structure was probably first folded at this time as is indicated by local deep denudation, and by the thickness of carbonate sedimentation which followed in Strawn time. Very thick clastics were deposited in this area during early Permian time, and the related tectonic movements may have caused local faulting. Gentle folding of the upper Wolfcamp strata is thought to have occurred in Leonard times, Fig. 5.

ISOPACH MAP of the Strawn including the reef. Fig. 5.



The Noelke Reef

Fig. 5 is an isopach of the Strawn, including the reef. Recognition of organic reef at Noelke is based on several lines of reasoning. Perhaps the most diagnostic evidence here, as elsewhere, is the rapid vertical growth as compared with normal local rate of sedimentation. Available well data permit some direct interpretation of the reef form only on the west side; its character and extent to the east, however, are estimated on the basis of regional understanding. Fig. 5 clearly shows that the Strawn reef was not completely buried until early in the Permian.

The relationships shown on Fig. 5 are similar to those of other Pennsylvanian reef localities in the general area. The foundation for the very rapid Strawn reef growth is always a Strawn bedded limestone platform. Rocks adjoining the reef are dominantly upper Pennsylvanian and Permian basin clastics. Localization on the platform seems to be determined by the position of gentle folding and local increase in the thickness of the shelf limestone, as at Noelke. Depth of water on the shelf and local currents, irrespective of local folding, also influence the location of reef.

Other evidence leads to recognition of a reef, such as at Noelke. Nonbedded clastic limestone of marine origin is a useful clue. A very wide range in the character and dimensions of the porosity is typical of a reef. And finally its position relative to basin and shelf, and the age of the basin-fill clastics provide important related data.

Reef theory . . . The rapid upward growth of a reef occurs at a time of

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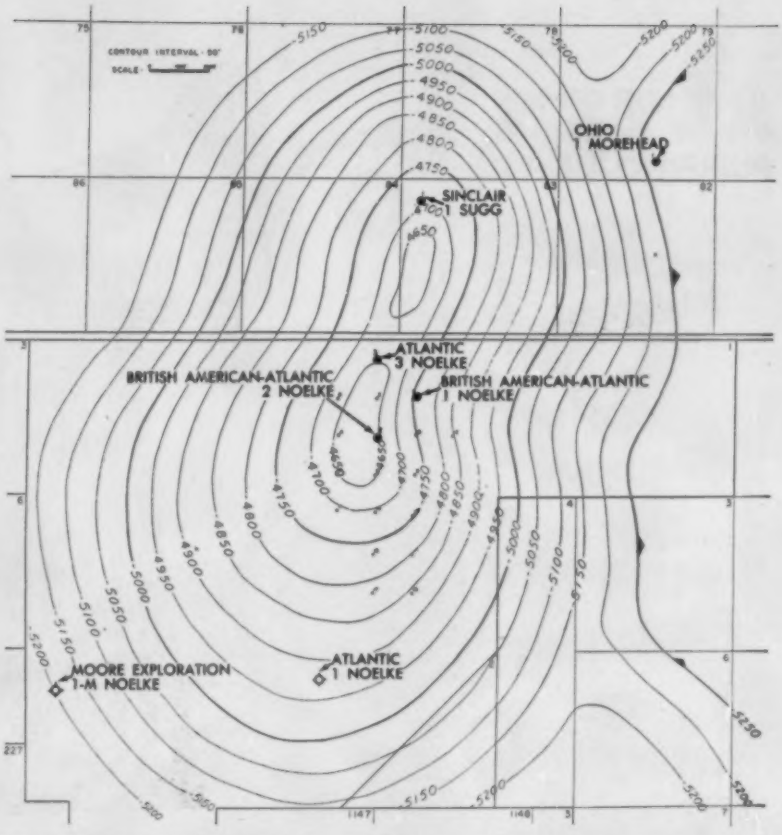
increasing depth of water, and whether it be thought of as owing to subsidence, or to transgression has only a relative bearing on the subject. It does not occur at a time of regression or local uplift. The rapid upgrowth of a reef occurs in response to an association of events. Of these the most important are the percentage of C_aCO_3 in solution in the water and the depth and temperature of the water. Highly oxygenated water which is free from clastics in suspension, and a location adjacent to currents transporting essential minerals are also important. Of lesser importance is the character of the sea-floor.

Rapid organic reef growth under these conditions is confined to a narrow zone of vertical growth facing the open sea. The extremely rapid upgrowth provides a vast quantity of detrital which is deposited on the shelf side of the reef, and a much smaller amount which rolls down the steep seaward face. The great mass of the reef, then, is detrital carbonate.

The fact that fossils are often found in the fossil reef is due to incidental organic growths in frontal and lagoonal areas; to the burial of large fragments; and to preservation of parts of the growing front. If the reef is later buried beneath marine clastics, as at Noelke, the reef front will have been modified by post-reefing submarine erosion and detritus.



STRAWN STRUCTURE showing the reef platform and folding of the Pennsylvanian. Fig. 6.

Production History

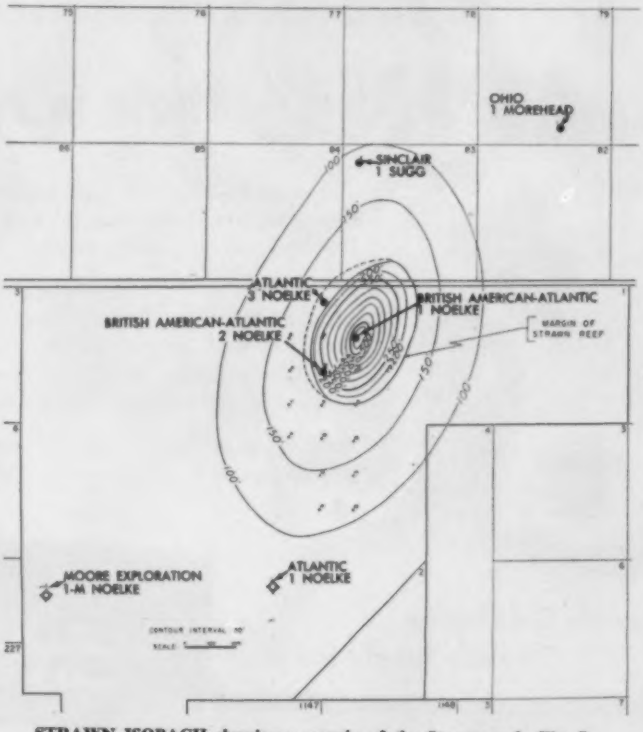
Sixty-Seven (Noelke reef) field is in a stage of early development with only two wells now producing from the Strawn. The reef discovery well, British-American 1 Noelke, had a net pay of 65 ft. with top of pay at 6,877 ft. It had a flowing IP of 207 bbl. of oil per day from the top 10 ft. of the reef limestone.

British-American and Atlantic 2 Noelke, completed in May 1956, had a net pay of 7 ft. with top of pay at 6,921 ft. It had a flowing IP of 177 bbl. of oil per day.

Permeability of the reef pay zone is 20-40 md.; the porosity is about 9 per cent. Production life has been estimated at 20 years with a top allowable of 3 years. Oil from the 1 Noelke is 53.8° gravity and it has a gas-oil ratio of 1,686:1. The 2 Noelke produces 45°-gravity oil and has a gas-oil ratio of 1,490:1.

Cumulative production as of January 1, 1957, for both wells was 36,990 bbl.

Production from the San Angelo formation was found in the 3 Noelke after the Strawn failed to produce. The San Angelo productive zone is a thin sandstone with about 7 ft. of pay. A small amount of structure is present in this part of the Permian section. **End.**



STRAWN ISOPACH showing a margin of the Strawn reef. Fig. 7.

THESE FOUR NEW FIELDS discovered this year plus five fields opened late in 1956 give the Galveston Bay area top billing.

Inshore-Offshore Drilling Hits All-Time High at Galveston

. . . bay areas draw wildcatters

by Nell Williams
Associate Editor

WHILE Texas waits the launching of full-scale exploration of offshore oil and gas potentialities underlying its portion of the Gulf of Mexico, it is feeling a new spurt of drilling activity under some of its "inshore" offshore areas, specifically the major bays along its coast.

Particularly noticeable is the stepup in activity in Galveston, and its associated bays, in which there now are upwards of 15 active drilling operations.

Galveston Bay and its various arms comprise an over-all area of approximately 480 sq. miles, or 307,200 acres, located in the heart of the Texas coast's most prolific producing area. Although drilling has been done in this bay since 1939, and 14 separate fields have been found, only a relatively small portion of the total bay area has been prospected. Combined productive areas of present fields total less than 6,500 acres.

Within a radius of 10 to 15 miles around its shores, there are such large (both in area and productivity) fields as Hastings, Webster, Dickinson-Gillock, Goose Creek, Barbers Hill, South Dayton-South Liberty, Esperson, Anahuac, High Island, and many others. These are names prominent in Texas Gulf Coast oil development.

None of the bay fields so far has assumed the size and importance of some of the above bordering onshore fields. But, based on the density of fields in a comparable area around the bay, a sizable number of fields remain to be found within its borders if its field density is equal that onshore around it. Out of these, there may be another Hastings, Webster, or Anahuac.

Since the present spurt in drilling got under way late in 1956, five of the bay's 14 separate fields have been opened. Production of another of the bay's bordering onshore fields has been extended into the bay with a new-reservoir discovery.

Two of the new-field discoveries and the extension (shown on the accompanying map) were drilled this year. The new fields are Southwest Red Fish Reef, on the west side of Galveston Bay proper, and West Trinity Bay, at the north end, in the Trinity Bay arm. Both were opened in January.

Southwest Red Fish Reef field, 2 miles southwest of the original Red Fish Reef field, opened by Humble Oil & Refining Co. and now one of the bay's most important producing areas, was discovered by Sun Oil Co. Its discovery well, in Section 288, is oil productive from Frio sand at 9,358-65 ft. Sun's second well has just been completed as a gas-condensate producer from a deeper Frio pay at 10,343-47 ft. The same company has three additional active operations in the immediate area. They are indicated on the map at K, in Section 307; L, in Section 288; and M, in Section 287.

Humble Oil & Refining Co. opened West Trinity Bay field with a gas-condensate well, located in Section 14-E, and productive from Frio sand at 8,850-61 ft. Its second well, completed last week, opens a slightly shallower gas-condensate reservoir, perforated at 8,506-17 ft. Humble has one active operation in the area (C on map).

The new bay production, opened early in March, at Goose Creek, one of the coast's old salt dome fields, was discovered by The Texas Co. The discovery, in Tract 361, not only ex-

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tends Goose Creek production more than a mile but also opens a new reservoir, and may prove a new field. The discovery well is productive of oil from sand at 3,960-70 ft. The same company now is on its second well, in the same tract, shown at D on the map.

Three additional new fields discovered the latter part of 1956 included North Red Fish Reef, opened by Sun Oil Co.; North Fishers Reef, opened by Continental Oil Co.; and Trinity River Delta, in the far-north arm of Turtle Bay, by Union Producing Co.

Anahuac Townsite field, shown at the top of the map as a 1957 discovery, is not in the bay, but is close to the shore, and is inspiring additional drilling that may extend it into the bay. It was opened at the turn of the year by Group Oil Co. with gas production at 8,600 ft. Union Producing Co. has two active locations in the general area, one at B, 2½ miles northeast, in Tract 37, in Turtle Bay, and the other at A, in Tract 36, Trinity River Delta area.

With its 15 drilling operations and new locations, the bay's activity is at a new peak. In addition to drilling already listed and keyed to the map, Tidewater Oil Co. has two deep tests drilling, one in Section 114 (H) and the other in Section 206 (I), north and west, respectively, of North Red Fish Reef field. North of these, and southeast of Cedar Point field, the bay's first field (discovered in 1939), John Mecom is starting a deep test in Section 116 (F). It is southeast of Sun Oil Co.'s test (E), in Section 117, abandoned in February as dry at 9,006 ft.

Sun is starting another deep wildcat at (G), in Section 88, northeast of North Red Fish Reef field. Humble Oil & Refining Co. is on a new deep test in Section 225 (N), on the east side of Red Fish Reef field. It is drilling below 10,700 ft. on a wildcat in Section 314 (Q), west of Hanna Reef field, and has location in Tract 179 (O), just offshore from East Robinson Lake field, in the East Bay arm. Southeast of this, The Texas Co. has a location in Section 189 (P).

Exploration this year has included five deep wildcat tests already abandoned as dry. Most recent failure is a 14,100-ft. test drilled by Humble Oil & Refining Co. 3 miles offshore from Texas City in Section 113-A (R). It had promising showings but tested unsuccessfully with perforations at 10,325-26 ft. Humble also failed in an 8,677-ft. test in Tract 6-E (T), in Trinity Bay. The Texas Co. drilled to 10,200 ft. in a wildcat in Section 303 (J), off Kemah. Brazos Oil & Gas Co. quit a 6,700-ft. test in Tract 31 (S), in the West Bay arm, off Alligator Point field.

(See box page 179)

EXPLORATION HIGHLIGHTS

APPALACHIAN

PENNSYLVANIA

In Mount Pleasant Township, Westmoreland County, Southwest Pennsylvania, Peoples Natural Gas Co. 4109 B. H. Smithley, wildcat, elevation 2,001 ft., was successful, initial open flow 2,564,000 cu. ft. gas, chert 7,364 ft., gas, Oriskany sand 7,497 ft. Total depth 7,539 ft. This company's 4123 Earl Shultz is shut down at 540 ft.

EASTERN KENTUCKY

Northeast of Sizerock and located on Left Fork of Elkhorn Creek, United Fuel Gas Co. is drilling at 3,889 ft. in probable Upper Ordovician strata at their wildcat 28 Fordson Coal Co. This test, projected to reach Cambro-Ordovician formations, topped Mississippian Big lime at 1,630 ft. and Devonian black shale at 2,202 ft.

OHIO

A producer, having probably the largest initial production of any drilled in Sego pool, was completed along the north edge by Trenco Oil Co. on 1 (2) Carl Taylor, Section 16, Madison Township, Perry County. Clinton was logged at 3,065-3,119 ft. with 30 bbl. natural and 600 bbl. in a 24-hour test after fracture.

● Kinsell Oil Co. stepped out ⅗ mile south of Junction City field and brought in a combination well on 1 Russell Lott, Section 29, Jackson Township, Perry County. Clinton at 2,868-86 ft. was fractured and the gage was 1,250,000 cu. ft. gas and 40 bbl. oil in 24 hours.

● A record well for New Guilford pool in Perry Township, Coshocton County, was brought in by Clinton Oil Co. on 2 Orla Johns, Section 4, an east extension. The Clinton was logged at 3,228-82 ft. with a good showing natural and 380 bbl. in a 10-hour test after fracture.

FLASH

Tidewater Oil Co.'s deep wildcat test in Section 114, Galveston Bay, is being completed as a gas-condensate producer from perforated interval at 7,838-44 ft. in Frio sand.

Identified as a drilling test (H on map, page 177) it adds another new-field discovery to this year's activity in the bay area.

It tested a flow rate of 1,000,000 cu. ft. of gas and 25½ bbl. of condensate per day. Flow was through small chokes with pressure of 2,550 psi.

Location is a mile north of North Red Fish Reef field, in Section 132, where Sun Oil Co. has one dually completed well, productive of oil at 8,624-30 ft. and gas at 8,530-40 ft.

CALIFORNIA

CALIFORNIA

Texaco Scores Twice In Oxnard Region

The Texas Co. completed 1 Livingston northeast of the Oxnard field in Ventura County for a new pool discovery. It flowed 311 bbl. daily of 29.50°-gravity crude from 8,649-8,811 ft. The 9,035-ft. discovery is more than ¾ mile from the nearest Oxnard field production. This well is near the Oxnard Air Force Base and is expected to spark a drilling flurry in the area. When the Government acquired the land for the base, the original owners retained mineral rights but are not allowed to drill on the air base proper. Any drilling will have to be done from surface locations off the base. There are prospective drill sites on the north, east and west borders of the airfield.

In an exactly opposite direction from the Air Base discovery, Texaco completed a good producer in the new Diedrich pool activity 1 mile southwest of Oxnard field. This well, 2 Diedrich, was completed flowing 449 bbl. daily of 22°-gravity crude from a Sespe interval at 6,590-6,683 ft.

Paloma Test Deepens

Continental Oil Co. was drilling below 10,120 ft. on 55-8 KCL in NW SE 8-32s-27e. This deep test is located about 1 mile southeast of the nearest production in Paloma field of Kern County. Operators are watching the Conoco test closely as it is located only about 4 miles east of Ohio Oil Co.'s former depth record holding 72 KCLA which was abandoned several years at 21,482 ft. in SW NE 4-32s-26e.

Fillmore OK's Drilling

The Fillmore City Council, Ventura County, granted Atlantic Oil Co. permission to drill a well within the city limits. This will be the first well ever drilled within the corporate limits of this small agricultural town. Drilling is expected to start within 90 days and is aimed at extending production of Richfield Oil Corp.'s recent discovery on the northeast flank of the deep Fillmore field. A soundproofed rig will be used.

Reserve Whips Water Problem at Tejon

Reserve Oil & Gas Co. successfully solved the water problem which plagued its recent new field discovery 3 miles north of Tejon field and recompleted the 13,061-ft. wildcat flowing 276 bbl. daily of 31.3°-gravity crude. Reserve shut off the deepest interval and left five others open between 11,850-12,207 ft. It produced more than 900 bbl. of water to 200 bbl. of crude when originally completed weeks ago. This well is located in SW SE 18-11n-19w.

Humble Finds Gas Field

Humble Oil & Refining Co. completed 1 Schohr in NE NE 23-18n-1e, flowing 5,073 M.c.f. daily through a ½-in. choke for a new gas field discovery in the West Biggs region of Butte County in northern California. The new gas field is about 6 miles northeast of Wild Goose field and is the first test drilled in this township-range. The well was taken to 4,755 ft., plugged back to 2,675 and completed in the interval 2,578-93 ft.

CANADA

ALBERTA

Discovery Reported in Vulcan and Browning Areas

The Imperial Oil, Ltd.-Canadian Superior Oil of California, Ltd., team, met with success in two separate areas of western Canada during the 7-day period just passed. Both of the wells are being operated by Imperial and lie in the

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Vulcan area of southern Alberta and the Browning area of southeastern Saskatchewan.

The Vulcan area venture, Imperial-Canadian Superior 1-5 Vulcan, on LSD 1, 5-18-23w4 is 38 miles east-southeast of the Texaco-C. & E. A1-25 High River D1 zone of Devonian oil discovery well, and 28 miles due north of Imperial's 4-17 Carmangay basal Banff oil discovery hole. Calgary's city limits lies 60 miles northwest of the strike, while the town of Vulcan is 8 miles southwest.

During drill-stem test in the basal Blairmore formation and fifth to date on the well, a pipe recovery of 430 ft. of oil and 30 ft. of mud was made. The subsequent four tests were not released by the operator but it is thought that the recent encouragement was all the well has given up thus far.

... Saskatchewan. Switching to the new strike in Saskatchewan, Imperial-Canadian Superior 3-35 Browning, on LSD 3, 35-6-5w2, it was revealed that a series of six test evaluations were conducted on the Mission Canyon sector of the Mississippian formation. The best recovery on those tests was made during the fifth one run. During that test, a pipe recovery of 50 ft. of oil-cut mud, 1,920 ft. of clean oil and 100 ft. of salt water was made. The previous four tests also gave up oil but the sixth contained 1,600 ft. of salt water, indicating that the pay zone had been penetrated.

Casing has been set on this venture which lies 3 miles north of the Tidewater 14-11 Browning Crown Mission Canyon zone oil discovery well and 11 miles north of oil production in Steelman field.

BRITISH COLUMBIA

Two Wells Indicate Oil or Gas Strikes

Two wells in the northeastern sector of British Columbia have indicated the presence of oil or gas during recent testing operations. One of those wells was drilled by the Northern Foothills Agreement Group which includes, Mobil Oil of Canada, Ltd., Texaco Exploration Co., British American Oil Co., Ltd., and Shell Oil Co.; while the other well was drilled by Richfield Oil Co. of California and is currently being production tested by the other partners in the venture, Western Decalta Petroleum, Ltd., and Alberta Pacific Consolidated Oils, Ltd.

The N.F.A. well was drilled in the Boundary Lake area, 17 miles north-northwest of oil production in the Boundary Lake Triassic zone oil field. The only test released was classed as a partial misrun by the operator but pipe recovery consisted of 40 ft. of clean oil and 210 ft. of oil and gas-cut mud.

This test, Texaco-N.F.A. 6 Boundary Lake, was drilled on LSD 14, 22-88-16w6. The group's 2 Boundary Lake gas success lies 6 miles south-southeast while the Texaco-N.F.A. 3 Boundary Lake current wildcat suspension lies the same approximate distance west-southwest. The well has been carried to total depth and production casing is set, however, due to the impassible terrain at the present time in the area, further production tests have been suspended until the summer months.

The other well, Richfield-Decalta 1 Big Arrow Creek, is in unsurveyed territory at 57 degrees, 08 minutes, 48.9 seconds North Latitude and 120 degrees, 45 minutes 38.93 seconds West Longitude. It is 61 miles north of Fort St. John townsite and about 8 miles northwest of the Hudson's Bay-Union 1 Milligan Creek Triassic zone oil discovery.

This venture was drilled last winter by Richfield Oil Corp. but due to the muskeg conditions prevalent in the area was suspended until this freeze-up. During initial production tests in the basal Triassic formation a gas flow rate calculated at open flow to be 4,600,000

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cu. ft. daily was obtained from a 1-ft. perforated interval in the horizon. Further test operations are being conducted up hole at the present time.

ILLINOIS BASIN

ILLINOIS

One of Williamson's Best Oil Hits Reported

Ward Dayton has one of the best discoveries yet in Williamson County at his 1 Richard Mann in SW SW NW 23-8s-4e, 7 miles west of Galatia and 11 miles northeast of Marion. The McClosky lime discovery flowed oil during drill-stem test at 3,034-40 ft. Recovery was 1,140 ft. of clean oil. Location is 5 miles from production.

LOUISIANA

SOUTH LOUISIANA

Lake Pelto Oil Discovery Opens New Coastal Field

An oil discovery 4 miles southwest of production in Lake Pelto field, on the Terrebonne Parish coast is reported by Union Oil Co. Monterey Oil Co. is joint operator.

The discovery well, on State Lease 2649, flowed at the rate of 198 bbl. of 33.5°-gravity oil per day while testing through 7/64-in. choke. Flow was with gas-oil ratio of 521 cu. ft. per barrel, and pressure of 1,800 psi.

Pay is perforated at 10,716-24 ft. Hole was drilled at 13,225 ft.

Palmetto Bayou Area Gets Shallow Production

Shallow oil production is being opened in the Palmetto Bayou area in southwestern Terrebonne Parish's coastal marshes.

Its discovery is by Humble Oil & Refining Co. at its 3-W L.L.&E., completed with pay perforated at 2,620-23 ft. The area's other two productive wells were completed in sands below 13,000 ft.

Completion flow of the shallow well was at the rate of 504 bbl. of 35.8°-gravity oil per day. It was gaged through ⅛-in. choke, with pressure of 4,850 psi. and gas-oil ratio of 746 cu. ft. per barrel.

Location is about ½ mile southwest of Humble's initial well, completed in December 1955 with pay at 13,640-45 ft. That well also was good for more than 500 bbl. of oil (35.4°-gravity) per day, flowing through ⅛-in. choke.

The area's other productive well, east offset to Humble's deep discovery well, was completed by Superior Oil Co. last July from a slightly shallower pay, perforated at 13,128-32 ft.

Three additional deep tests drilled by Humble in the area failed to get commercial production.

Superior now below 11,000 ft. on its second well, a location south of its initial well.

Deep Production Spreads In Caillou Island Area

Production in the widely spread Caillou Island field, at the mouth of Timbalier Bay, Terrebonne Parish, is being extended 2 miles southwest in a 17,961-ft. well drilled by Placid Oil Co. and Pan American Petroleum Corp.

Completion of the well, 2 State Lease 2867, is in a 14,100-ft. sand, perforated at 14,143-58 ft. Tested through ⅛-in. in choke, the well flowed at the rate of 278 bbl. of oil per day. Its gas-oil ratio was 9,460 cu. ft. per barrel, and pressure 4,900 psi.

Gas-Condensate Producer Opens Allen Parish Field

Vincent & Welch and associates, of Lake Charles, have a gas-condensate

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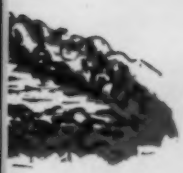

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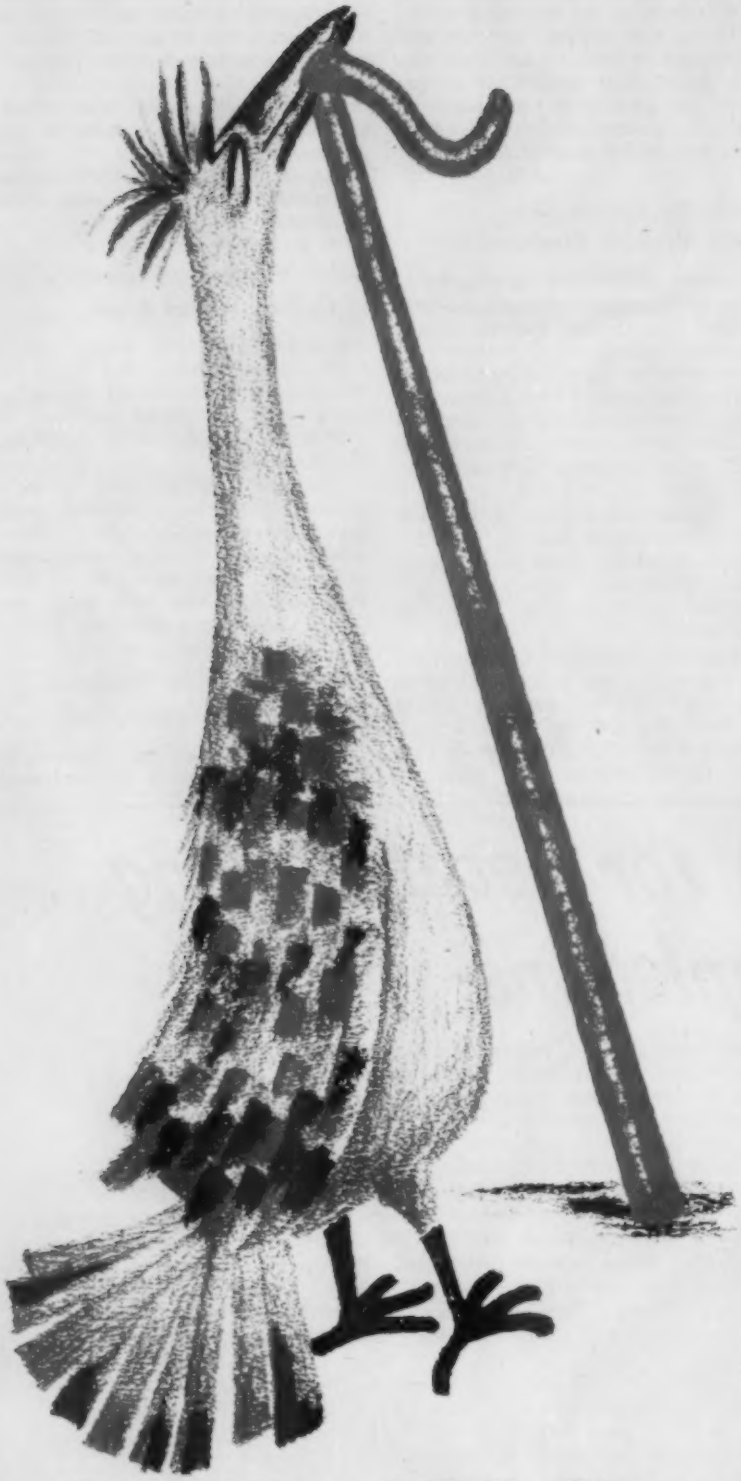

Otis Runs and Pulls Pipe
Under Pressure, Too. OTIS

discovery in the southwest corner of Allen Parish.

It is in their 1 Putnam, completed after testing 1,009,000 cu. ft. of gas and 101 bbl. of 58°-gravity condensate per day from perforations at 8,688-8,703 ft. Flow was through 5/32-in. choke under pressure of 2,770 psi.

Location is about 2 miles north of Elton, and about the same distance northwest of Basile. It is 1½ miles east of production in North Elton field.

Bayou Serpent Extension May Link Indian Village

Colorado Oil & Gas Co., of Houston, is opening oil and gas production in the narrow gap between Bayou Serpent and Indian Village fields, in northwestern Jefferson Davis Parish.

The discovery, in sand at 8,528-31 ft., is about 1½ miles west of the former field, and about the same distance east of Indian Village. It is on the operator's Lock-Moore lease, in 28-7s-6w.

The well was cleaned through small chokes and flowed with pressure of 3,650 psi It has been shut in without gaging pending installation of completion facilities.

LOUISIANA OFFSHORE

New-Pay Well Confirms Far-Offshore Discovery

Sinclair Oil & Gas Co.'s confirmation well in its Eugene Island Block 175 field, in the Gulf of Mexico 50 miles off St. Mary Parish, is giving the field its second oil-productive sand.

The new pay is perforated at 11,780-94 ft. Although perforated interval is only 24 ft. shallower than that of the discovery production is from separate zones.

The second well, a location east of the discovery well, flowed at the rate of 407 bbl. of 37°-gravity oil per day through ⅛-in. choke. Flow was with gas-oil ratio of 830 cu. ft. per barrel, and pressure of 4,500 psi.

Discovery well was completed last June. Since then Sinclair has drilled two dry holes. One was sidetracked out of the first.

The wells were drilled from a self-contained platform in water 87 ft. deep. They are 75 miles from land base at Morgan City.

Book Review

This should be the best year in history for the oil and gas industry in the Rocky Mountain region. Figures summarizing last year's regional operations show the stage set for new records in 1957.

Complete summary of 1956 oil and gas

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activity is contained in Petroleum Information's Resume of Rocky Mountain Oil and Gas Operations for 1956. The new book . . . twenty-seventh such volume published by the Denver oil information service firm . . . is now in distribution.

Statistics show that new records were set in almost every phase of the oil industry in the Rockies in 1956. During the year, 4,956 wells were completed in Rocky Mountain states. By comparison, in 1950 only 1,105 wells were completed.

Total production set a new record, with an increase of a little more than 13 per cent over the previous year. Regional production averaged more than 597,000 bbl. per day. Some states showed very large gains in production. Nebraska was up 50 per cent, Montana 37 per cent, North Dakota 16 per cent. Colorado and Wyoming increased 11 and 7 per cent respectively.

The oil industry spent more than $1,186,000,000 in the region in 1956 . . . passing the $1 billion annual total for the first time.

During the year, discoveries of major importance were made in the Four Corners area, particularly in southeastern Utah. Upwards of 300 million barrels of new oil is credited to this district, making it the most rewarding dry land area of oil activity in the United States for 1956.

New pipelines went into operation . . . began to supply Rocky Mountain gas to the Pacific Northwest states. Still other pipelines were announced to link the new Four Corners producing area with oil-short areas of the Pacific Coast.

Additional gas transportation facilities to southern California were planned during the year.

Leases sold by the Navajo Indians to operators in the Four Corners area put the Navajos among the most well-to-do tribes in the nation.

The Williston basin, one of the most widely heralded oil provinces in the country over the past 5 years, was back in the spotlight in 1956, with discoveries promising much increased activity there.

The Denver basin of Colorado and western Nebraska, one of the country's most active spots for independent small companies, continued as an intensely worked oil area, with new drilling records set in the western Nebraska portion in particular.

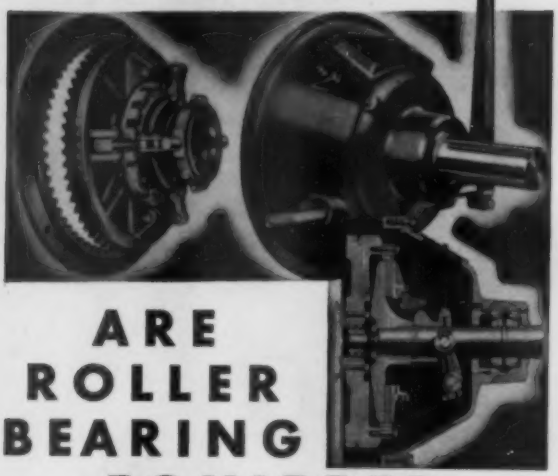
Petroleum Information's review summarizes regional oil economics, techniques, production, markets, exploration, and leasing in 85 pages of text and illustration. The volume also contains a summary of each discovery made in the region, gives a list of all Rocky Mountain units, lists all the region's refineries, lists 1956 and cumulative production of each field in the region, and lists location, total depth and status of every well completed in the Rockies during the year.

The volume contains a total of 234 pages, and includes a map of the entire region showing the location of each of the 178 discoveries made during 1956.

The book is available from Petroleum Information offices in Denver, Casper, Billings, Bismarck, and Los Angeles.

ROCKFORD

POWER TAKE-OFFS



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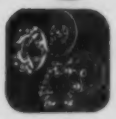
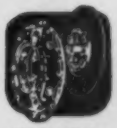
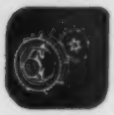

Small Spring Loaded


Heavy Duty Spring Loaded

Oil or Dry Multiple Disc


Heavy Duty Over Center

Power Take-Offs

Speed Reducers

CLUTCHES

MICHIGAN

Development Pick Up Due at Wayland "6"

New developments at several offset and close in locations in thee new Wayland "6" Traverse oil pool, Wayland Township, Allegan County, may kick the lid off development. Five new locations were announced this week for immediate drilling.

Most spectacular and significant of three new wells to drill pay section in the field was the diagonal southeast 10-acre offset to the discovery at Ford Henry and Jack Hobson 1 Cook-Consumers Power Co.-Buchardt Comm., NW NE NE 7-3n-11w, which was flowing at the rate of 10 bbl. of oil an hour at the end of the seventh hour following a 1,000-gal. acid treatment. Well pumped and flowed at the rate of 125 bbl. of a day natural.

This offset logged Traverse lime top at 1,697 ft. Pay was drilled between 1,699-1,704 ft. Hole filled 1,100 ft. with free oil natural first 3 hours after pay was tapped.

Deepened 5 more feet in Squaw Bay Traverse, after 7-in. casing had been pulled, Frank E. Rousch and J. C. Voorhees 1 Mahoney, NE NE NE 34-10n-3e, St. Charles Township wildcat, Saginaw County, headed up and flowed 50 bbl. of oil in 24 hours through about 1,200 to 1,500 ft. of water. Well made a second 24-hour flow of 50 bbl. the next day. Well originally flowed 150 bbl. of oil in 3 days from this pay before csaing was run, but after well was cased and tubed, only recovery reported was about 3 to 4 bbl. of oil and 12 bbl.

of water a day. Present total depth is 2,319 ft. It was not believed that additional pay had been penetrated by deepening. Further tests will be run.

New St. Charles Township, Saginaw County, Squaw Bay Traverse wildcat oil well was killed with salt water after about 160 bbl. of oil had been produced natural, flowing by heads, in 3 days to allow operators to set long string of 7-in. casing on a packer and perforated bottom joint at 2,314 ft., present total depth.

This wildcat, Frank E. Rouse and J. C. Voorhees 1 Mahoney, NE NE NE 34-10n-3e, was being swab-tested following casing program this week. First day on test, only salt water, with a gradual increase in gas, showed. Operators now believe that packer on long string of casing is not holding effectively. Casing may be pulled and another packer inserted into casing string. Traverse lime was topped at 2,306 ft. Pay showed between 2,312 ft. and total depth. Well flowed 90 bbl. of oil natural first 24 hours after pay was tapped.

● Clifford A. Perry was drilling deeper in Trenton at his oil-gas discovery well in Scipio Township, Hillsdale County, at the 1 Houseknecht, NW SE NE 10-5s-3w. Cable tool drilling was progressing slowly with an excessive amount of gas keeping cable tool bit off its feet so that driller was unable to determine if it was effectively cutting new hole. Wildcat, which showed for about 2,000,000 cu. ft. of gas a day and an oil spray of about 4 bbl. an hour on test, logged top of the Trenton at 3,575 ft. Gas showed at various points between there and original total depth, at about 3,794 ft. Oil pay first showed in quantity at 3,776 ft.

NEW MEXICO

NORTHWEST NEW MEXICO

Confirmation Well Tested in San Juan

Sunray Mid-Continent Oil Co. and Sinclair Oil & Gas Co. have tested the 1 Es-Ka-Nel-E-Wood in San Juan County, New Mexico, for a daily rate of 672 bbl. of oil through a 28/64-in. choke.

The well is a confirmation to the Anderson-Prichard discovery which opened a pool in the southeast Bisti area. Production is from the Gallup sand with perforations at 4,905-23 ft. and 4,933-47 ft. The well flowed natural on the 7-hour test. Tubing pressure was 400 lb. and gas-oil ratio was 1,020 to 1.

Total depth of the hole is 5,100 ft. Oil gravity is 38.5°.

The well, located at NE SW 22-25n-11w in San Juan County, is operated by Sunray. Sunray and Sinclair hold in excess of 1,600 acres in the immediate area. The second well on the lease is ready to drill.

TEXAS PANHANDLE

Near-Record Oil Well Completed in Hansford

One of the northwestern Anadarko basin's biggest oil well to date was completed by Shamrock Oil & Gas Corp. in Hansford County, 10½ miles north of Spearman in Section 50, Block 45, H&TC Survey.

The prolific well flowed 2,176 bbl. of oil daily on ¾-in. choke from Atoka-Penn perforations at 6,667-83 ft. The well is the 1 Edith B. Steele "B."

OKLAHOMA

NORTHWEST OKLAHOMA

New Pool Looms In Woodward Area

Champlin Oil & Refining Co. has an indicated lower Morrow gas-distillate discovery just south of the city

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of Woodward in Woodward County. The 1 McDonald, C SE NW 1-22n-21w, about 6 miles northwest of the sole producing area in the county, Southeast Woodward field, tested gas and distillate in the Morrow sand at 8,270-8,302 ft. Testing information has not yet been released by the operator.

Successful completion of this wildcat would open the second field in the area. Last year Union Oil Co. of California established prolific Morrow sand gas-condensate production at the 1 McCormick, heralding a new era for Morrow exploration on this near-shelf area of the northwest Anadarko basin.

ROCKY MOUNTAIN

COLORADO

Hygiene Is New Denver Basin Producing Zone

The Denver basin gained a new pay, the Hygiene of Upper Cretaceous (Pierre shale) age. Discovery well is The California Co.'s 1 Denny, SW NE SE 27-7n-67w, Weld County. The well pumped 90 bbl. of oil daily from perforations at 4,274-83 ft., opening production from this new pay in both the basin and New Windsor field. New Windsor has Lyons-Permian production at 9,000 ft. Location is 4 miles southwest of Black Hollow-Permian field.

OREGON

First '57 Oregon Test Under Way

Standard Oil Co. of California was drilling ahead below 1,500 ft. on 1 Kirkpatrick in 6-4s-21e. This wildcat, located in the Condon area of Gilliam County, is Oregon's first this year.

UTAH

Here is the latest and westernmost discovery in the Paradox basin play . . . Pan American Petroleum Corp. 1 Featherstone, NW SW SW 24-40s-22e, San Juan County, Utah. The discovery flowed 273 bbl. of oil daily on 20/64-in. choke during tests of perforations at 5,405-36 ft. in the Paradox-Pennsylvanian. It's location slightly northwest of West Desert Creek makes Featherstone the westernmost oil production in the Paradox basin. East-west length of the so-called Aneth trend is now just over 20 miles from Featherstone to East Aneth near the Colorado line.

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Abstracts

HERE is the second group in a series of selected abstracts from the February meeting of the Rocky Mountain Association of Petroleum Geologists held in Salt Lake City.

Stratigraphic Influence on Oil Entrapment, Cut Bank Area, Montana

ROBERT J. WEIMER, Golden, Colo.

OIL and gas production in the Cut Bank area of Montana is from three stratigraphic horizons: (1) a dolomitic zone at the top of the Madison group of Mississippian age; (2) the Cut Bank sandstone of Jurassic age; and (3) the Moulton-Lander-Sunburst sandstones of Cretaceous or Jurassic age. Production from each of these formations is related to porosity and permeability variations caused by facies changes or un-

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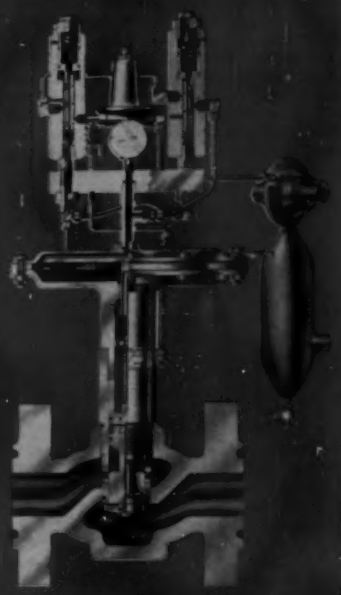

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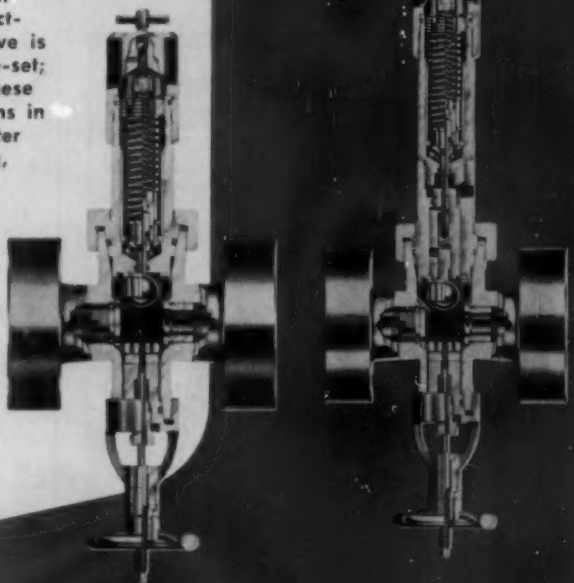

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conformities and associated with a regional uplift or local anticlinal folding. To illustrate this duel role of stratigraphy and structure in the oil and gas accumulation, three fields are discussed:

1. North Cut Bank (North Lime) field is typical of fields producing from the Mississippian dolomite. Production is structurally controlled by a north-plunging anticlinal nose and stratigraphically confined to porous zones in the upper 70 ft. of the dolomite, immediately underlying an unconformity. The porous zones were truncated to the south by post-Mississippian erosion and then overlapped by the impermeable shales of the Sawtooth formation (Jurassic). Subsequently, anticlinal folding in late Cretaceous or early Tertiary time formed the oil trap as it now appears.

2. Stratigraphic correlations by use of electric logs and sample logs confirm the interpretation by Blixt (1941) that accumulation in Cut Bank field is the result of an updip facies change from porous and permeable sandstone to impermeable marine siltstone, "ribboned" sandstone, and shale of the Swift formation of Jurassic age. Because of this relationship with the Swift formation, the age of the Cut Bank sandstone is Jurassic rather than Cretaceous as some former investigators have indicated. In the vicinity of Cut Bank field, the Cut Bank sandstone was deposited in a nearshore and shoreline marine environment. Equivalent finer-grained sediments in the Swift formation to the east and southwest were deposited in an offshore marine environment. These two environments of deposition account for the lithologic differences between the Cut Bank sandstone and the Swift formations.

3. Darling field is used as an example of oil fields producing from the Moulton and Lander sandstones. In this field porosity and permeability occur in a narrow sandstone lens that is believed to have been deposited as a shoreline sand in the late Jurassic or early Cretaceous sea. The permeable oil-producing sandstone is completely surrounded by impermeable beds.

The Red Wash-Walker Hollow Field, a Stratigraphic Trap in Eastern Uinta Basin, Utah

M. DANE PICARD, St. Helens Petroleum Corp., Casper, Wyo.

RED Wash-Walker Hollow, Utah's largest stratigraphic oil field, produces from the lowermost member (Douglas Creek) and the overlying Garden Gulch member of the Green River formation of Eocene age. One subcommercial gas well has been completed in the lower part of the Uinta (Eocene) formation, and a single oil well produces from the lower part of the Douglas Creek member and the upper part of the underlying Wasatch (Eocene) formation. Up to November 1, 1956, there were 50 oil and 6 gas wells in the field.

The percentage of sandstone and siltstone in the productive interval increases from 20 per cent on the southeastern edge of the field to 70 per cent on the northwestern edge, and isopercentage lines strike N. 45° E. The source was to the northwest, north, and northeast (ancestral Uinta Mountains) from preexisting sediments. The lithology of the productive interval is primarily a sequence of lacustrine sandstones and siltstones, which are mature, orthoquartzites for the most part.

The entrapment can be characterized as a complex, lenticular sandstone network blanketing a portion of a relatively large northwest to westerly, plunging anticlinal nose. Single sand lenses or closely related sandstone lens groups represent closed reservoir systems in themselves, and fluid separation is a reflection of relative structural position. Most sand lenses, or connected sandstone lens networks, go out to the southeast; however, there are some exceptions.

Isopach studies indicate that there may have been slight deformation at the beginning of Uinta time, forming one or more very minor closures in the area; but it is not believed that this tectonic activity was significant to the stratigraphic entrapment of oil and gas.

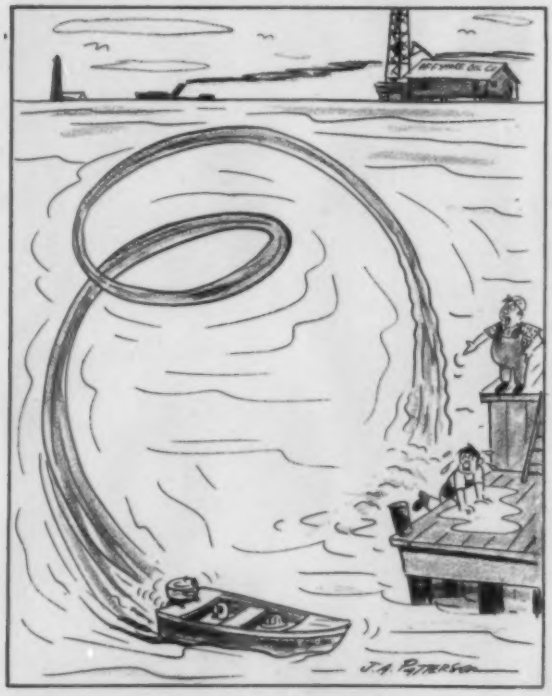
A Progress Report on the Development of Fracture Analysis As an Exploration Method

P. H. BLANCHET, Blanchet and Associates, Calgary.

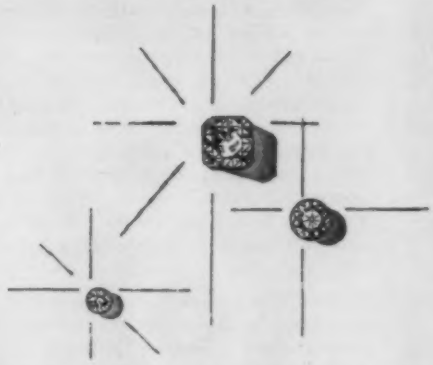
FUTURE analysis, through intensive research, is proving to be a relatively low cost and rapid photogeophysical exploration method, especially for oil and gas and, in all probability, for ore deposits. These fracture analysis surveys involve the recognition, on aerial phographs, the measurement, and the analysis of locations or rectilinear features which are considered to be the surface expression of deep-seated fractures, joints, or fracture zones.

As part of active exploration programs for oil companies, 60 areas, totaling 25,000 sq. miles, in many widely scattered parts of the Great Plains region of Canada and the United States, have been analyzed in detail. On the basis of this work, the following summary statements are made:

1. In accordance with the present working hypothesis, many of these lineations or fractures were initiated at or near basement level



"Next time, get all the way in before you start it."



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by the flexing action resulting from crustal tides and, probably, other, lower frequency movements. Such fracture zones are considered to have been propagated and multiplied upwards through the sediments by this action (essentially vertically, at least in areas where the underlying sedimentary rocks are laterally homogeneous, where the surface is essentially plains in character, and where there is reasonable absence of major orogenic disturbances). This propagation continues to the surface, even through topsoil and thick glacial overburden.

2. Four principal fracture directions or sets are present in all areas examined, and are probably present in most, if not all, sedimentary areas at least.

3. From one area to another, the orientation of the mean direction of each fracture set is regionally systematic, not haphazard, which is plausibly explainable by hypothesis.

4. Local deviations in the statistical mean direction of one or more fracture sets, and/or in the fracture incidence (number of unit fractures per unit area), is quantitatively indicative of underlying, even deep-seated, structure or stratigraphic anomalies. Such deviations are being mathematically analyzed to approximately recover the location, size, and form of the anomalies.

Potential Stratigraphic Oil Accumulations in Upper Cretaceous Sands, Powder River Basin, Wyoming

JOHN F. BARTRIDGE, JR., consulting geologist, Casper, Wyo.

THE Powder River basin of Wyoming offers potentialities for oil and gas accumulation in stratigraphic traps in Upper Cretaceous sands. The basin is an important oil-producing province today, but offers important potentialities for increased production in the future. The sands of the Upper Cretaceous are major objectives in this projection of future production. Numerous sands, present in the outcrop and in the subsurface, along the west flank of the basin are not present, either in the outcrop or in the subsurface along the east flank of the basin. By virtue of the asymmetrical structural shape of the basin, potentialities for oil and gas accumulation exist in stratigraphic traps in the updip pinchout of these sands on the gentle east flank. Discoveries in the past few years, while perhaps not commercial, are indicative of the potential for the future.

The Upper Cretaceous of the Powder River basin includes the section from the base of the Newcastle or Muddy sandstone through the Lance formation. The Newcastle or Muddy sandstone is not included in this discussion as it is an individual and complex problem and has been discussed recently by others. The Lance formation is not discussed as it does not appear to offer the simple potentialities of the other parts of the section. Therefore, this discussion is limited to the remaining portion of the section which includes the Mowry, Frontier, Niobrara, Cody, Mesaverde, and Lewis formations of the west side of the basin. The sands lie in the Frontier, Cody, Mesaverde, and Lewis formations.

Oil is being produced from these sands in accumulations controlled by anticlinal closure and fault closure. Stratigraphic control, however, is an important factor in these accumulations. Discoveries in 1953 and 1956 in the Powell and Shawnee units, while perhaps not commercial at this time, and shows in other wildcats indicate the potentialities for stratigraphic accumulations in the updip pinchouts of these sands on the gentle east flank of the basin.

The sands are described briefly and the environments of deposition are postulated. Maps are presented to show the areal distribution of the individual sands. Isopach maps are presented to offer an explanation for the occurence of the sands.

Additional wildcatting will be necessary to realize the potential of these sands. Such wildcats must be considered in the rank category in the near future due to the sparse control and the lack of strong structural features in the relatively undeformed basinal areas. There is currently a strong interest in these potentialities and an active exploratory effort is foreseen for the Powder River basin of Wyoming.

Geology of the Pembina Field, Alberta

A. M. PATTERSON and **A. A. ARNESON,** Merrill Petroleums, Ltd., Calgary.

PEMBINA field is an excellent example of a stratigraphic trap. The oil occurs at the updip (eastern) termination of sands of the Upper Cretaceous Cardium formation. The probable area of the field appears to be somewhat in excess of 800 sq. miles. Production is obtained from at least four separate sands and a conglomerate of the Cardium formation. In some areas all of these reservoirs are developed one above the other and are separated by shale breaks. As the areal distributions of the various reservoirs do not coincide, the lean and rich areas in the field can be determined by maps outlining the distribution of the various sand bodies.

There are now over 1,600 producing wells in the field. The daily (prorationed) production is about 106,000 bbl. The total recoverable primary reserve has been estimated in excess of 1 billion barrels.

Pembina, situated on a hinge-line, is in an area of multiple stratigraphic traps. Other than from the Cardium, oil and gas have been obtained from the Basal Belly River sands, the Viking sand, a Jurassic sand, and the Mississippian carbonates. All these occurrences are within the limits of the Pembina field and all are stratigraphic traps. The reservoirs in these horizons have not been evaluated to any extent at present. These reserves will probably not equal those of the Cardium but they will be of very considerable size.

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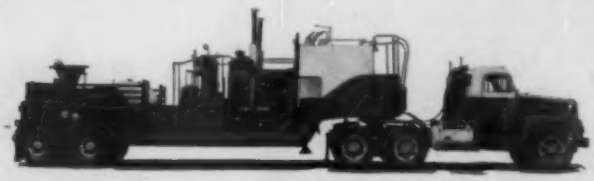

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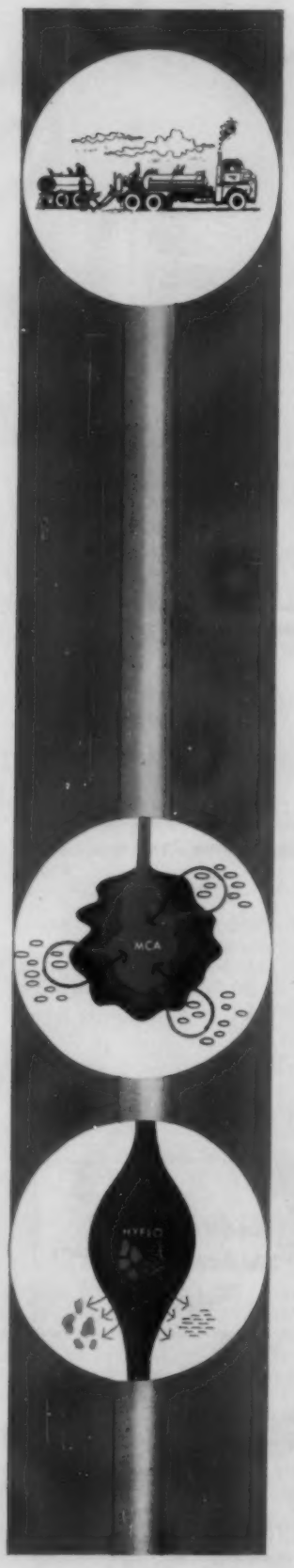

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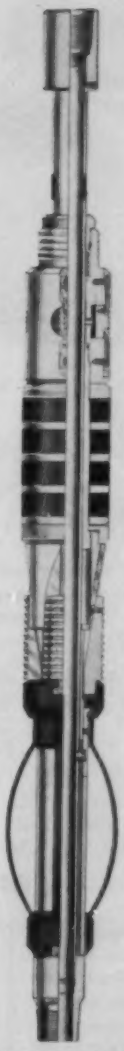

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West Texas Still Good for Big Discoveries

ROUTINE drilling reports from West Texas may have the answer to the old question of where the area's new fields will be. Last week, two big discoveries and one good prospect were being wound up near existing production. In Crane County the discovery had a number of old dry holes around it, but apparently they didn't discourage the operator.

Connell and Devonian oil . . . In Crane County, Gulf Oil Corp. 21 Lea, SW SW Section 47, Block 32, PSL Survey, prepared for dual completion. One flow gage from Connell (Middle Ordovician) perforations at 8,466-88 ft. was 228 bbl. of oil in 24 hours through 15/64-in. choke. Gas-oil ratio was 570:1 and tubing pressure 915 psi.

A 22-hour flow test on Devonian perforations at 6,126-6,200 ft., following fracture treatment, gaged 484.5 bbl. of oil and 9 bbl. of water in 22 hours. Total depth was 8,730 ft., plugged back to 8,676 ft.

Location of 21 Lea is over 1 mile south of Lea multipay field.

Midland County . . . A Devonian discovery and Strawn extension to Azalea field was in the making at Murphy H. Baxter 1-1 Crespi Unit, Section 20, Block 38, Township 2 South, T&P Survey. Locaiton is about ⅝ mile north of the two-well Azalea field.

No. 1-1 Crespi Unit was also a dual well. Potential from the Devonian, the discovery zone, was 442 bbl. of 47.5° oil, from perforations at 11,400-11,520 ft. Gas-oil ratio was 3,650:1. Choke size and pressures were not reported.

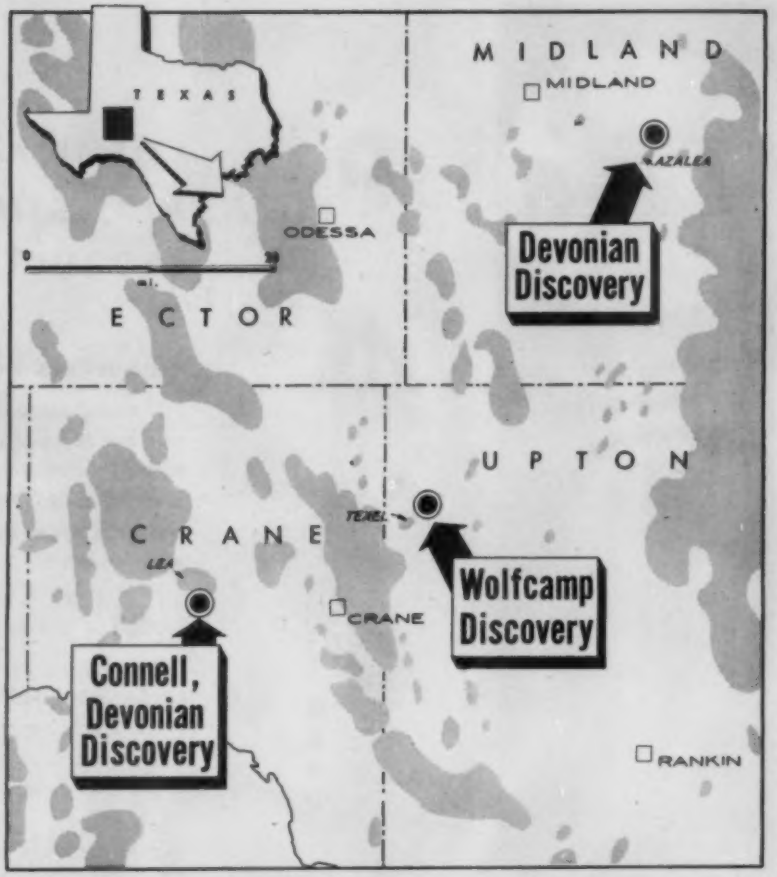
Completion from the Strawn was 1,101 bbl. of condensate a day through 18/64-in. choke, plus gas estimated at 7,600,000 cu. ft. Perforations were at 10,330-54 ft.

Azalea field was opened by Murphy in May 1956, for 11,100 M.c.f. of gas and 1,461 bbl. of 60° condensate.

Upton County prospect . . . Pure Oil Co. 1 TXL, wildcat 3 miles northeast of Texel field, was drilling ahead on contract depth of 13,150 ft. The well flowed oil from one section of the Wolfcamp, recovered oil from another test in the same formation, and at last report logged good shows while coring Strawn limestone.

The oil flow came on a test at 9,594-9,650 ft. Oil surfaced in 28 minutes, and flowed 220 bbl. in 5½ hours. Flowing pressure ranged from 1,235-2,325 psi., and increased to 3,350 psi. when shut in. A test at 9,764-80 ft., which was either Wolfcamp or Pennsylvanian, recovered 16 bbl. of oil.

Sample top on the Strawn was 9,758 ft., and oil shows were cored between 9,780-9,802 ft.



These discoveries are: Gulf Oil 21 P. J. Lea, in Crane County; Pure Oil 1 TXL in Upton, and Murphy H. Baxter 1-1 Crespi Unit, Midland County.

Oil Shows in West Central Tests

uled Cambrian wildcat southwest of Water Valley, recovered 3,340 ft. of 41° oil on a drill-stem test of the Wolf-

Tom Green County . . . British-American Oil Producing Co. 1 Cargile, schedcamp at 5,682-5,705 ft. Wolfcamp sand was logged from 5,678-98 ft.

Location is in Section 15, Block 5, H&TC Survey. Projected depth is 9,000 ft.

Coke County . . . Plymouth Oil Co. 1 T. E. Tidwell, offset to the 1-well West Wendkirk (Crosscut sand) field southwest of Bronte, had the Ellenburger as a new pay. Drill-test at 6,124-70 ft. had oil in 27 minutes, but rate of flow was not estimated. Bottom-hole flowing pressure was 2,365 psi.

In Ralph Harvey, producers get a . . .

. . . Live Wire in North Texas

THOSE who know Ralph Harvey, Jr., think things will be popping in the North Texas oil patch this year.

Harvey, they say, is a live wire. And if he decides to do something, he gives it his all.

They tell you, for example, that he and his brother Eugene decided Uncle Sam needed their efforts in World War II, so they junked a thriving drilling-contracting business and joined the Air Force.

When Harvey was mustered out, as a captain, he had to start from scratch. And rigs were hard to come by in 1945. But Harvey Drilling Co. is back in business again, making more hole than before. Along with the contracting, the company also has developed its own production—about 600 bbl. daily in North Texas.

On March 30, the North Texas Oil and Gas Association chose Harvey as its new president.

He wasted no time getting started. Two days later, he was in Austin as one of the leaders in the independents' fight to get Texas' 8,000 or more unconnected wells hooked up to pipelines (see page 63).

Harvey thinks this is one of his rougher problems this year. He points out that producers in his home North Texas area, District 9, are having to truck about 320,000 bbl. of oil a day. Profit is melting away due to high trucking charges. And wildcatting and development are falling off in the area accordingly, he says.

He feels that the import problem is extremely serious. But the worst situation of all, he thinks, is that the public has such a poor opinion of the industry. This, Harvey thinks, is something that must be corrected and quickly.

Under his leadership, he says, the association's biggest aim will be to try to "arouse the membership that it's responsible not just to find and produce oil. Each one must also feel it is his job to tell his neighbor and anyone who will listen about the oil business . . . what he does and why and what his problems are."

Up the long way . . . Harvey is 45 years old, but looks younger. He was born in Seymour, Tex., about 50 miles west of Wichita Falls, his present operating headquarters.

His father was R. O. Harvey, a cotton broker who got the oil fever during the Burkburnett boom and went on to become a well-known and successful wildcatter. One of his discoveries was the big Desdemona (Hogg-town) field.

Young Harvey finished high school in Wichita Falls. He went to Washington and Lee University for 2 years from 1929-31, then returned to Texas to finish up work on his degree in business administration at Texas University.

He worked in the cotton-exporting business from 1933-35 but switched to oil and started roughnecking in Archer County oil fields in 1935. In the next 2 years he worked up to a position as a driller and quickly formed Harvey Drilling with brother Eugene. Ralph was operating partner.

The brothers bought a new Wilson "Giant" rig rated at 5,000 ft. and jumped with both feet into the big K.M.A. field boom. Ralph says the company was lucky in that it was launched in just the right place at the right time. Harvey Drilling added two more rigs by 1942 and was growing rapidly when the brothers left to get into the war.

The company has built itself back now to an even better position. It again has three rigs. It has production in Cook, Montague, Clay, Wichita, Archer, Young, and Throckmorton counties.

The comeback is largely due to the fact that Ralph Harvey, Jr., is, indeed, a live wire.

Personals

The North Texas Oil and Gas Association has elected **R. J. Moran,** vice president of Moran Brothers, Inc., Wichita Falls drilling contractor, as first vice president. **George W. Anderson, Jr.,** was reelected executive vice president, and **James W. McCutchen,** managing partner of McCutchen & Graham, drilling contractor of Wichita Falls, has been reelected second vice president. **Ralph O. Harvey, Jr.,** was named president (see above). Harvey succeeds **Wayne O. Watts** of Wichita Falls.

George F. Watford has been named exploration manager for Commonwealth Oil Co., Houston. A graduate of Texas Technological College, Watford was formerly district geologist in Houston for Pan American Petroleum Corp. He had been with Pan American, formerly Stanolind Oil & Gas Co., since 1948.

Aaron B. Neely, division mechanical engineer in Shell Oil Co.'s Houston production department, has been transferred to Denver as senior mechanical engineer, production. **Perry O. Roehl,** exploitation engineer in the company's Billings, Mont., division, has been transferred to Denver as production geologist.

Personals

J. M. Barton, Northern Natural Gas Producing Co.'s exploration manager, has been appointed vice president. Barton joined Northern Natural Gas Producing in 1953. He had previously been chief geologist for Cooperative Refinery Association of Wichita and Deep Rock Oil Co. He was also with Magnolia Petroleum Co. at one time.

Ben P. Piepgrass, manager of Midstates Oil Corp's San Antonio, Tex., office, has been named manager of operations in East Texas, Arkansas, and northern Louisiana, and transferred to Shreveport, La. **V. T. Irby,** assistant manager at San Antonio, will succeed Piepgrass there.

Samuel P. Dickens, assistant supervisor of fuels research at The Texas Co.'s Port Arthur-Port Neches, Tex., laboratories, has been appointed supervisor of project evaluation research at the company's Beacon, N. Y., research center. Dickens has been with Texaco since 1943.

C. W. Stose, general manager of crude-oil purchases and sales at Atlantic Refining Co.'s Philadelphia refinery, has been appointed general superintendent of the process division. **W. O. Hoffman,** superintendent of the refinery's mechanical department, has been named general superintendent of the services division.

J. M. (Sam) Lewis, former chief engineer of M. J. Crose Manufacturing Co., Inc., Tulsa, has joined Carter Oil Co. to work on drilling-methods research at the company's Tulsa laboratory. Lewis previously was with Williams Brothers Co., pipeline constructors.

Gordon Hillhouse, senior engineer in Midland, Tex., for Sunray Mid-Continent Oil Co., has been appointed South Texas district engineer and transferred to Corpus Christi. **Herman Owens, Jr.,** senior engineer, has been named South Louisiana district engineer in Lafayette, La. **Walter Kellogg,** reservoir engineer in Tulsa, has moved to Lewisville, Ark., as district engineer in the Tri-State district. Kellogg replaces **W. D. Elliott,** recently transferred to Oklahoma City. **Tom Brinkley** will succeed Kellogg as reservoir engineer in Tulsa.

Richard L. Robinson, petroleum engineer in Houston for Standard Oil Co. of Texas, has joined Plymouth Oil Co. in Midland, Tex., in the same capacity.

Dr. W. A. Gorman has resigned as vice president of Drilling & Exploration Co., Inc., Houston, to become exploration manager for Royal Oil & Gas Corp.

Virgin E. Balke, formerly with Alex W. McCoy Associates, Tulsa, has joined National Cooperative Refinery Association as geologist in Denver.

S. J. Matthews, Oklahoma City district engineer for Cities Service Oil Co., has been promoted to assistant division engineer for the South Oklahoma-North Texas production division. He has been with Cities Service since 1947.

Charles F. Horton, Jr., formerly with Union Producing Co. in New Orleans and Shreveport, La., has joined Wheless Drilling Co. in Shreveport as production engineer. A graduate of Louisiana State University, Horton had been with Union since 1950.

H. Alan Nelson, chief petroleum engineer of Blackwell Oil & Gas Co., has been elected a vice president. A graduate of Texas Technological College, Nelson has been with Blackwell since 1955. He was formerly with Pan American Petroleum Corp.

R. W. KREBS

Dr. Robert W. Krebs, associate director of Esso Research & Engineering Co.'s Baton Rouge, La., laboratories, has been promoted to director of the company's chemicals-research division. He succeeds **Dr. William J. Sparks,** recently named scientific adviser. **Dr. Fred W. Banes,** acting associate director of the chemicals-research division, has been appointed associate director. Krebs has been with Esso since 1937, Banes since 1943.

K. W. Brill has been promoted by Continental Oil Co. from central region general manager in Oklahoma City to assistant to **E. F. Battson,** vice president and chairman of the executive committee. Brill will transfer to New York. He has been with Conoco since 1930. He was assistant general manager of the southern region in Houston before going to Oklahoma City in 1953.

O. N. Miller, vice president of Standard Oil Co. of California, Western Operations, Inc., has been elected a vice president of Standard Oil Co. of California, the parent company. A graduate of the University of Michigan, Miller has been with Standard of California since 1934. He was general manager of the company's manufacturing department until 1954.

A. D. Togna, assistant supervisor of the analytical and testing department at The Texas Co.'s Beacon, N. Y., research center, has been appointed supervisor of the new products testing department there.

L. C. Lindeblad, subsurface geologist with Pan American Petroleum Corp., has resigned to become a consulting geologist in Roswell, N. M. Lindeblad had been with Pan American since 1943.

Jack Marshall, formerly district superintendent in Ardmore, Okla., for Continental Oil Co., has joined Nelson-Spain Contractors & Producers in Ardmore as superintendent of production.

Wilbur H. Seifert, senior engineer and chief geologist with R. A. Ransom in Washington, D. C., has opened offices as a consulting geologist in Oil City, Pa.

C. H. Novotny has been appointed staff engineer in the Houston manufacturing department of Jefferson Chemical Co., Inc. Novotny was formerly at the company's Austin laboratories.

Karl Finsterbusch, vice president and a director of Stone & Webster Engineering Corp., has been appointed managing director of E. B. Badger & Sons, Ltd., of London, subsidiary of Stone & Webster.

C. T. McLaughlin, Snyder, Tex., has been elected president of the reorganized Sharon Ridge Producers and Royalty Owners Association. The association's aim is to try to find a firm market for crude oil from the Sharon Ridge Field of West Texas. **French M. Robertson,** Abilene, has been elected vice president of the association and **R. H. Ratliff,** Colorado City, Tex., secretary-treasurer. The group was active in the late 1940's before it merged with the West Central Oil and Gas Association.

L. S. OSBORNE

Lee S. Osborne, Union Pacific Railroad's assistant to the vice president for oil development, has moved up to vice president. He succeeds **William Reinhardt,** who has retired. Osborne was a division manager with Shell Oil Co. before joining Union Pacific in 1949. Reinhardt had been with the railway since 1937. He was formerly general manager of the Kettleman North Dome Association and at one time was a vice president of Shell Oil Co. He is a director of the Western Oil and Gas Association.

Henry Walrond has been appointed head of Sunland Refining Corp.'s new Bakersfield exploration office.

Joseph W. Fusso, Jr., development geologist with The California Co., has been appointed geologist in exploration and transferred to New Orleans from Natchez, Miss.

Bill R. Payne, division exploration geologist with Humble Oil & Refining Co., has been promoted to assistant division geologist and transferred to Houston from Wichita Falls.

George T. Naff will retire as vice chairman of the board of Texas Eastern Transmission Corp. April 30. Naff has been with Texas Eastern since 1947, the year the company was formed. He served the company as executive vice president, then president before being named vice board chairman last September. He will continue as consultant to Texas Eastern.

D. A. Howes, manager of petroleum chemicals for British Petroleum Co., has been named deputy assistant general manager of the company's research and development division. Howes has been with BP since 1932. **S. Porter** and **P. J. Hyde** have been appointed senior post chief engineers for BP Tanker Co. Porter joined BP in 1923; Hyde in 1931.

J. L. Shakely, president of Oklahoma-Mississippi River Products Line, Inc., has been appointed treasurer of the International Petroleum Exposition. Shakely succeeds the late Clyde Pape. **A. W. McKinney,** president of National Supply Co., has been named to the I.P.E. executive committee replacing the late Barton Myers. The next International Petroleum Exposition is scheduled for May 1959.

Ernest T. Pitzer, Jr., engineer with Shell Oil Co. in Wichita Falls, Tex., has joined DeGolyer & MacNaughton in Dallas.

Elwood L. Baldwin, formerly with Talala Oil & Gas Co. in Evanston, Ill., has joined Alex W. McCoy Associates, Inc., Tulsa consultants, as petroleum engineer.

Robert E. Nelson, geologist with Gulf Oil Corp. in Shreveport, La., has joined Nebo Oil Co. in Dallas as staff geologist. Nelson had been with Gulf since 1952.

Dr. William E. Humphrey, geologist with DeGolyer & MacNaughton and representative in Mexico and Spain for that company for the past 6 years, has joined T.U.L.M. Corp. in Houston.

Thomas L. Apjohn, manager of Mobil Overseas Oil Co.'s lubricating department, has been appointed manager of the company's new petroleum chemicals department. Apjohn joined Socony Mobil Oil Co. in 1936.

D. T. Lutz, superintendent of the Stinnett, Tex., compressor station of Natural Gas Pipeline Co. of America, has been appointed superintendent of compressor stations at Malvern, Ark., for Texas Illinois Natural Gas Pipeline Co., affiliate of Natural Gas Pipeline. Lutz succeeds **H. D. Jacobsen,** who has joined Western Pipe Line, Inc., in Austin, Tex.

R. T. Widney, special engineer with Cities Service Oil Co. in Bartlesville, Okla., has been promoted to superintendent of gas operations in the production division. Widney has been with Cities Service since 1948. He was Hugoton, Kans., district production engineer and development engineer in the natural-gas division until 1954 when he was appointed special engineer, handling gas production, drilling, proration, and gas sales contracts.

F. D. Aaring has been appointed chief petroleum engineer and **C. A. Buskel** chief gas engineer for British American Oil Co., Ltd. Aaring joined Gulf Oil Corp. in 1948. He transferred to Canadian Gulf Oil Co. at Calgary in 1949 and was division petroleum engineer when Canadian Gulf was merged with British American. Buskel was division gas engineer for Gulf in Tulsa before transferring to British American last fall.

Fred Powell, manager of the manufacturing department of Standard Oil Co. of California, Western Operations, Inc., has been elected a vice president and director of the company. Powell joined Standard of California in 1925. He is a former manager of the company's El Segundo refinery, assistant manager of manufacturing, and president of California Research & Development Corp., formerly a subsidiary company.

W. A. Kimbrough has been promoted by Pan American Petroleum Corp. from field superintendent of the company's Slaughter producing area at Brownfield, Tex., to assistant district production superintendent at Midland, Tex. He replaces **N. S. Whitmore,** recently named district superintendent at Lubbock, Tex.

John M. Gardiner, president of Republic Oil Refining Co., has been named vice president in charge of refining operations for Plymouth Oil Co. Republic Oil, a subsidiary of Plymouth, was merged with its parent company last week. It will continue operations as the Republic division of Plymouth. Gardiner has also been named president of the Republic division. **L. W. Robbie** and **Roland Wentworth** have been appointed division vice presidents.

DEATHS

Milton Henry Scales, 61, president of Camay Drilling Co., Long Beach, Calif., died March 22.

Henry H. Sessions, 61, former owner and president of Emblem Oil Co. of Long Beach, died March 27 in Indianapolis, Ind.

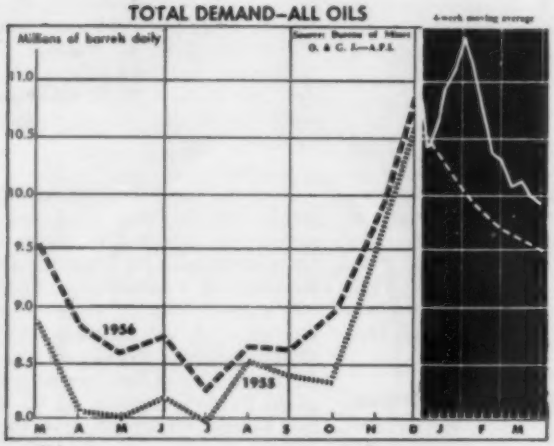
Thomas James Geser, Titusville, Pa., oil operator, died March 27 in Titusville.

John Wesley Gilliland, 75, pioneer southwestern oil man, died March 29 in Dallas. Gilliland was founder of the Gilliland Oil Co. and was active in development of numerous oil fields including Cushing, Hominy, and Osage in Oklahoma, Burkburnett in Texas, and Homer and Haynesville fields in Louisiana.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,797,025	DOWN	20,450	UP	521,114
Crude stocks	254,102,000	UP	2,181,000	DOWN	5,935,000
Completions	897	DOWN	269	DOWN	109
Refinery runs	8,099,000	UP	123,000	UP	405,000
Gasoline stocks	203,489,000	DOWN	2,032,000	UP	5,280,000
Kerosine stocks	20,168,000	UP	190,000	UP	2,835,000
Distillate stocks	75,855,000	DOWN	1,748,000	UP	13,272,000
Residual stocks	37,098,000	UP	212,000	UP	3,202,000
Four-product stocks	336,610,000	DOWN	3,378,000	UP	24,589,000
Total imports	1,379,700	UP	123,300	UP	203,000



Drilling for the First Half Will Barely Reach Last Year's Record

TOTAL well completions for the first quarter will be 500-600 wells fewer than for the first quarter of 1956. This could mean that total drilling for the first half will be no larger than last year.

If there is no gain in the first half, it would be the first period of no gain since the disruption caused by the steel strike of 1952.

In the last half of 1952, completions dropped below the total for the first half and below the last half of 1951. The period of low completions extended into the first half of 1953 when the total for the 6-month period was less than for the first half of 1952.

Following the steel strike last summer, drilling slowed down enough to hold last-half completions to 29,322 wells, only 1.7 per cent more than for the first half. Drilling also has been off in the first quarter of this year. It may do no more than catch up in the second quarter. The table at the bottom of the page shows drilling data for each half year since 1950.

Current figures indicate that drilling is not following the same pattern that was set by the strike of 1952. Material shortages were more severe after the 1952 strike. Drilling was off enough in the last half of 1952 so that completions in the first half of 1953 actually topped the total for the last half of 1952. Note in the above table that this is the only case since 1950 when first-half completions actually exceeded the total for the preceeding last half.

The low total for the first half of 1953 could be charged in part to a continuing shortage of steel. There seems to be no real material shortage for the first half of this year.

For the first quarter of 1957, the largest decrease is in Oklahoma, down from last year by better than 500 wells. Kansas and the Illinois basin also reported sharp drops. Texas showed a net gain. Increases in East, North, and West Texas plus the Panhandle more than offset decreases in the Gulf Coast and Southwest districts. Large gains were reported for Northwest New Mexico and smaller increases in the southeastern area of the state.

The shift in southern Louisiana throws a little light on the over-all trend in drilling. There was a big gain in offshore completions and a larger decrease in South Louisiana onshore. Higher costs for offshore drilling more than balanced the larger decrease in onshore completions.

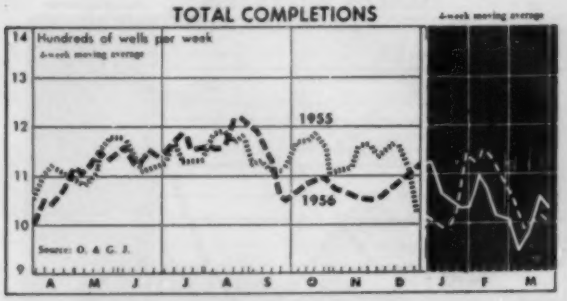
For the country as a whole, increases in offshore drilling and deeper onshore drilling will mean greater drilling expenditures for the first half even if completions show no gain.

Expenditures for drilling correlate closely with total income from crude. Crude production may be up as much as 5.0 per cent. Crude prices advanced about 9.0 per cent in January. Even with some allowance for inflation, producers will have at least 10 per cent more money coming in this year than in 1956. Some may have spent part of 1957's expected income in 1956. The number of well completions for the year is not expected to gain more than 3.5 per cent.

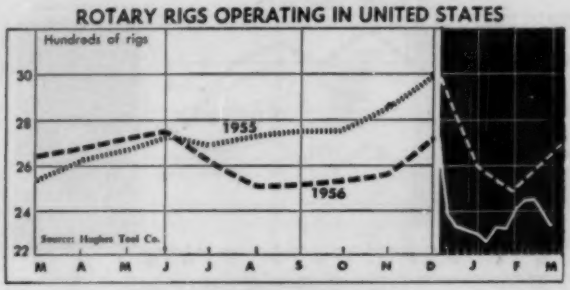
TOTAL COMPLETIONS

	First half	Second half	Year	Per cent gain, second over first
1950	20,216	23,063	43,279	14.1
1951	20,766	23,750	44,516	14.4
1952	23,187	22,634	45,821	—2.4
1953	23,163	26,116	49,279	12.7
1954	25,904	28,026	53,930	8.2
1955	27,696	28,986	56,682	4.7
1956	28,838	29,322	58,160	1.7

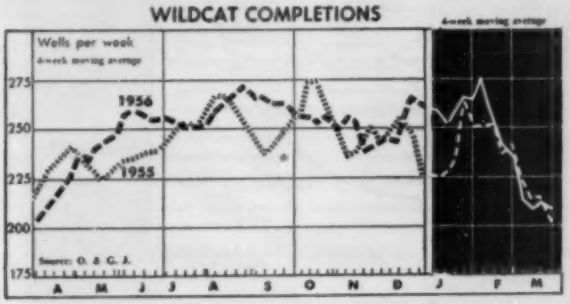
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS*

Area—	4-1-57	3-25-57	4-2-56
North Central and East	72	79	114
Southeast	35	34	30
Okla., Kans., Ark., Mo.	353	420	521
Louisiana	413	431	441
North and East Texas-Panhandle	388	397	438
Gulf and South Texas	227	220	264
West Texas-New Mexico	545	527	554
Rocky Mountain	199	191	222
Pacific Coast	95	97	128
Total United States	2,327	2,396	2,712
Western Canada	181	225	148

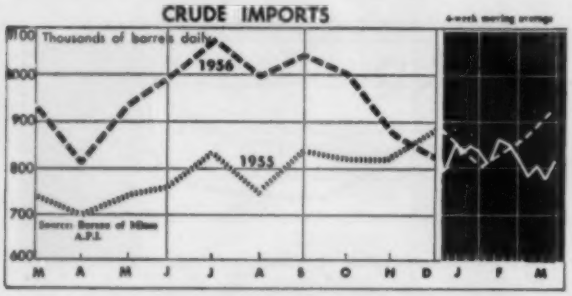
*Hughes Tool Co.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED MARCH 30, 1957

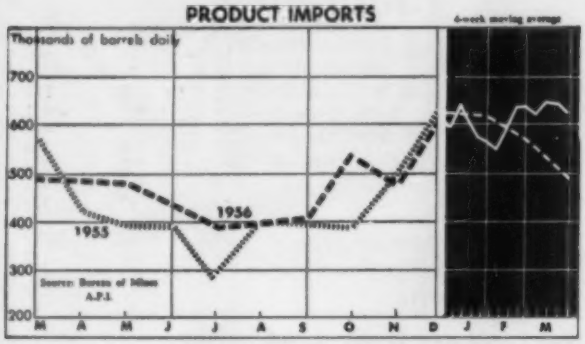
	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1957				
	Comp.	Oil	Gas	Dry	Footage	1957	1956	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.†	2	1	0	1	15,616	22	24	0	0	0	1	1	0	0	0	9	9
Arkansas	19	13	0	6	44,417	258	187	0	0	0	3	3	5	0	1	32	38
California	0	0	0	0	0	474	515	0	0	0	0	0	10	0	2	113	125
Colorado	13	3	0	10	61,664	256	266	1	0	0	8	9	8	0	3	162	173
Illinois	34	10	0	24	82,381	570	828	0	0	0	6	6	7	0	1	129	137
Indiana	7	2	0	5	9,432	150	157	0	0	0	0	0	3	0	0	25	28
Kansas	89	38	12	39	316,667	1,090	1,211	1	0	0	15	16	32	0	7	149	188
Kentucky	27	11	0	16	32,325	354	418	0	0	0	4	4	9	0	1	67	77
Louisiana	69	25	8	36	619,324	953	967	4	0	4	14	22	22	9	24	109	164
North	20	8	0	12	77,627	355	356	1	0	0	3	4	3	0	2	36	41
South	34	11	6	17	383,191	430	487	3	0	4	8	15	12	8	18	63	101
Offshore	15	6	2	7	158,506	168	124	0	0	0	3	3	7	1	4	10	22
Michigan	8	2	0	6	21,684	97	127	1	0	0	4	5	4	0	0	40	44
Mississippi	2	1	0	1	15,064	78	106	0	0	0	0	0	5	0	0	31	36
Montana	6	3	0	3	38,456	74	91	0	0	0	3	3	2	0	0	25	27
Nebraska	19	8	0	11	109,502	193	211	2	0	0	9	11	10	0	0	98	108
New Mexico	37	12	17	8	144,776	485	441	2	0	0	5	7	20	1	5	52	78
Northwest	23	4	17	2	92,761	187	147	2	0	0	1	3	10	1	4	16	31
Southeast	14	8	0	6	52,015	298	294	0	0	0	4	4	10	0	1	36	47
New York	0	0	0	0	0	113	.....	0	0	0	0	0	0	0	0	0	0
North Dakota	4	2	0	2	29,330	79	50	0	0	0	2	2	4	0	0	28	32
Ohio	32	20	4	‡8	86,643	266	277	0	0	0	0	0	0	0	0	3	3
Oklahoma	126	69	15	§42	475,778	1,664	2,184	0	1	2	10	13	28	6	3	149	186
Pennsylvania	1	0	1	0	7,539	301	*209	0	0	1	0	1	0	0	9	16	25
Texas	389	240	21	128	1,654,205	5,384	5,255	13	0	4	82	99	169	9	58	1,250	1,486
Southwest (1 & 4)	35	14	11	10	170,105	608	781	1	0	3	8	12	22	2	19	190	233
Gulf Coast (2 & 3)	39	21	5	13	250,390	636	663	0	0	0	8	8	14	4	29	175	222
East (5 & 6)	29	19	2	8	153,114	313	287	0	0	1	4	5	4	0	2	86	92
N. Central (7-B & 9)	155	87	0	68	432,078	1,977	1,807	8	0	0	46	54	88	0	3	562	653
West (7-C & 8)	110	84	1	25	559,461	1,523	1,422	4	0	0	15	19	39	0	4	216	259
Panhandle (10)	21	15	2	4	89,057	327	295	0	0	0	1	1	2	3	1	21	27
Utah	4	1	1	2	21,061	38	19	0	0	1	2	3	3	0	1	20	24
West Virginia	0	0	0	0	0	160	177	0	0	0	0	0	0	0	7	2	9
Wyoming	8	2	1	5	39,512	201	181	0	0	0	5	5	9	0	2	64	75
Miscellaneous	1	0	0	1	8,926	19	49	0	0	0	1	1	0	0	1	13	14
Total United States	897	463	80	354	3,834,302	13,279	13,950	24	1	12	174	211	350	25	125	2,586	3,086
Total previous week	1,166	592	130	444	4,556,477	.....	.....	26	3	6	164	199	326	24	113	2,412	2,875
Total Mar. 31, 1956	1,006	571	61	374	3,988,510	.....	.....	25	5	7	170	207	394	45	91	2,561	3,091
Cumulative 1957	13,279	7,023	1,003	5,253	54,900,383	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Western Canada	75	56	6	13	334,077	667	581	3	0	3	11	17	15	0	16	155	186

*Incl. N. Y. †Ga. one well, 4,151 ft. Service wells included: ‡3, §7.

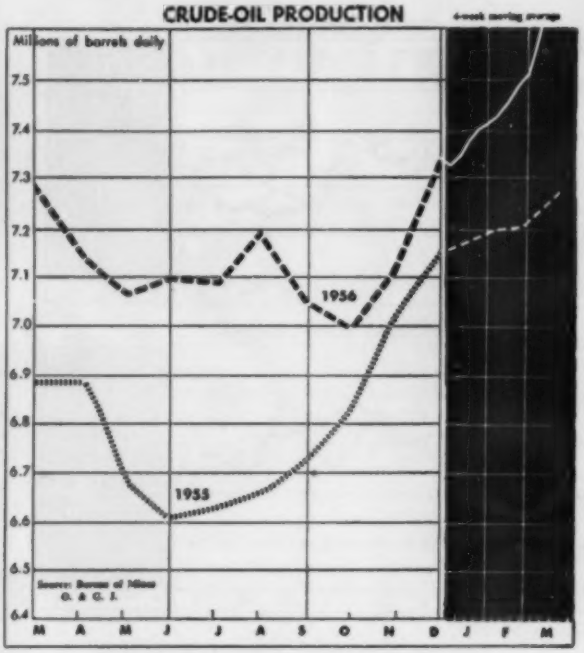
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION



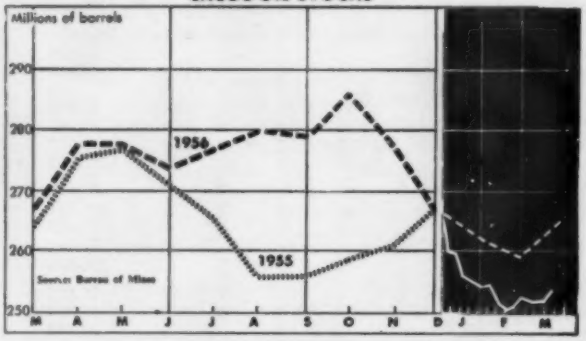
DAILY AVERAGE PRODUCTION FOR WEEK

	March 30, 1957			Mar. 23
	Crude oil	Lease condensate	Total	total
Alabama	11,700	.....	11,700	11,750
Arkansas	83,150	350	83,500	84,100
California	937,800	.....	937,800	939,600
Colorado	158,700	.....	158,700	160,100
Eastern	51,600	.....	51,600	51,400
Florida	1,250	.....	1,250	1,250
Illinois	228,500	.....	228,500	223,000
Indiana	31,700	.....	31,700	32,600
Kansas	†343,300	.....	†343,300	†358,500
Kentucky	47,600	.....	47,600	47,200
Louisiana	938,600	76,250	1,014,850	1,016,250
North	128,600	3,000	128,900	133,000
South	810,000	73,250	883,250	883,250
Michigan	27,400	.....	27,400	27,100
Mississippi	109,200	4,950	114,150	114,150
Montana	72,650	.....	72,650	72,950
Nebraska	37,850	.....	37,850	38,650
Nevada	100	.....	100	100
New Mexico	262,700	5,275	267,975	267,875
North Dakota	43,700	.....	43,700	30,750
Oklahoma	†669,900	.....	†669,900	†696,100
Texas	3,277,000	56,000	3,333,000	3,333,000
Dist. 1	57,000	550	57,550	57,550
Dist. 2	164,000	8,900	172,900	172,900
Dist. 3	459,000	26,300	485,300	485,300
Dist. 4	253,000	6,600	259,600	259,600
Dist. 5	44,000	475	44,475	44,475
Dist. 6	147,000	6,200	153,200	153,200
East Texas Field	229,000	.....	229,000	229,000
Dist. 7-B	173,000	100	173,100	173,100
Dist. 7-C	176,000	4,300	180,300	180,300
Dist. 8	1,254,000	1,425	1,255,425	1,255,425
Dist. 9	216,000	850	216,850	216,850
Dist. 10	105,000	300	105,300	105,300
Utah	13,300	.....	13,300	12,700
Wyoming	306,400	.....	306,400	298,250
Others	‡100	.....	‡100	‡100
Total U. S.	7,654,200	142,825	7,797,025	7,817,475
Change from prev. week, down			20,450	
Canada	†531,500	.....	†531,000	†556,100

Total U. S. production, January 1-March 30 ..... 673,471,475 bbl.
Same period last year (crude plus cond.) ..... *650,536,090 bbl.

*Includes 11,714,120 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

CRUDE-OIL STOCKS



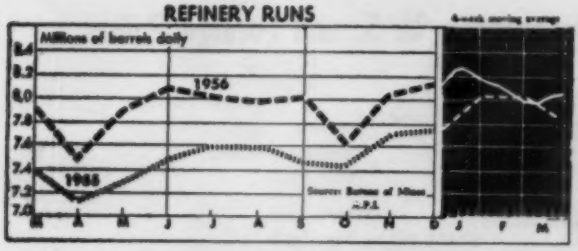
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

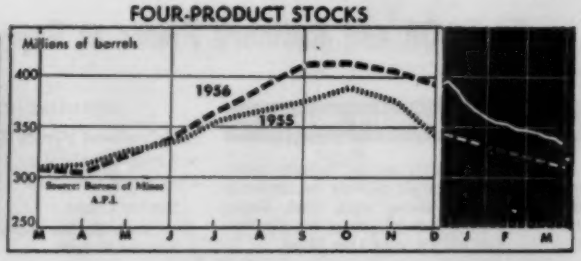
	3-23-57	3-16-57	3-24-56
Pennsylvania Grade	2,527	2,502	2,683
Other Appalachian	2,044	2,078	2,108
Illinois, Indiana, Michigan	9,073	9,479	9,604
Nebraska, North Dakota	1,915	1,951	2,079
Kansas	9,015	8,904	7,646
Oklahoma	22,982	21,485	23,506
Arkansas	2,529	2,424	2,702
Louisiana	18,630	18,310	15,984
North	2,840	2,902	2,583
South	15,790	15,408	13,401
Mississippi	2,133	2,140	3,101
New Mexico	7,386	7,362	7,608
Texas	114,281	113,556	121,615
East Texas proper	10,778	10,565	9,279
West Texas	53,227	52,932	59,668
Texas Gulf	21,841	21,520	21,900
Other Texas	28,435	28,539	30,768
Wyoming	17,043	16,994	15,884
Other Rocky Mountain	6,182	6,753	5,448
California	26,686	26,543	28,189
Foreign	†11,676	11,440	11,880
Total	254,102	251,921	260,037

*Bureau of Mines. †Includes 2,482,000 bbl. in California.

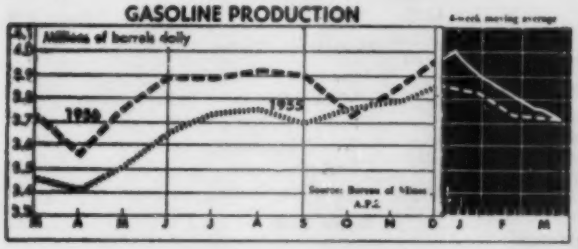
REFINERY RUNS



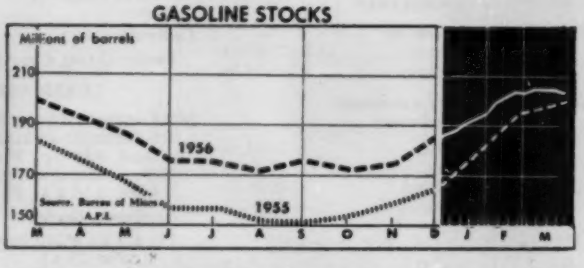
FOUR-PRODUCT STOCKS



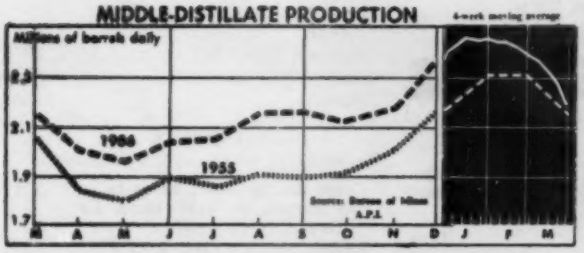
GASOLINE PRODUCTION



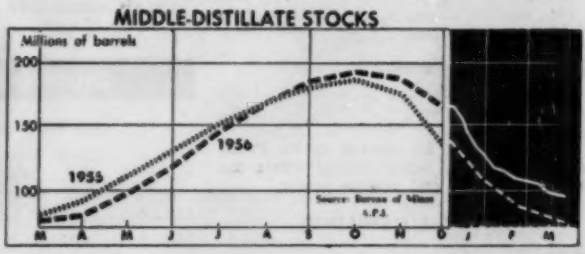
GASOLINE STOCKS



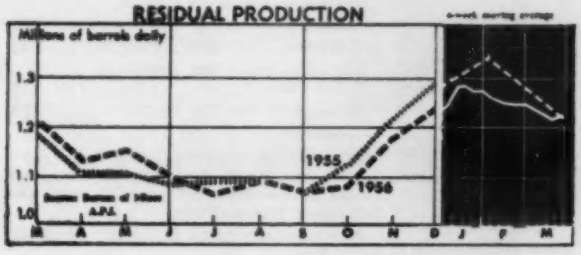
MIDDLE-DISTILLATE PRODUCTION



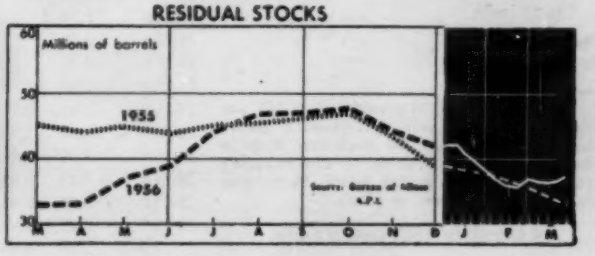
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, MARCH 29, 1957

(Thousands of barrels)

District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, March 1956—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,274	526.0	45.6	296.2	247.2	43,225	8,405	23,213	8,630	1,147	447.1	36.6	287.6	217.9
Appalachian:														
District 1	105	44.0	4.9	22.7	9.1	5,133	475	1,982	417	92	34.3	4.0	21.6	7.9
District 2	104	46.2	7.7	15.4	13.4	3,279	367	567	374	104	50.7	7.3	18.7	15.4
Ind., Ill., Ky.	1,429	717.0	70.4	291.4	189.6	36,558	3,648	12,026	4,867	1,394	704.1	74.5	287.3	184.9
Minn., Wis., Dak.	102	49.2	5.7	27.9	9.6	6,944	330	3,504	396	82	39.0	7.0	22.8	6.4
Okla., Kans., Mo.	662	351.4	18.4	153.3	24.9	21,234	781	7,252	798	666	372.5	18.4	159.4	35.3
Inland Texas	263	180.4	10.1	51.7	20.4	8,008	276	1,468	1,710	270	192.4	5.8	55.1	22.2
Texas Gulf Coast	1,958	874.4	93.9	493.7	231.1	27,256	2,831	8,186	4,768	1,983	902.3	113.5	529.9	251.3
La. Gulf Coast	622	271.0	38.6	166.9	42.0	11,403	1,594	4,501	1,536	713	344.6	58.7	173.2	52.9
N. La. and Ark.	98	43.7	5.0	25.3	6.6	5,159	889	1,696	136	71	24.1	4.3	17.3	3.2
Rocky Mountain:														
New Mexico	28	13.7	0.6	5.0	3.6	374	11	86	65	21	10.8	0.4	3.7	2.7
Other Rocky Mtn.	263	129.0	3.1	63.1	36.1	8,119	262	2,462	1,097	262	125.2	5.5	63.4	39.5
California	1,191	469.3	6.0	144.0	420.4	26,797	299	8,912	12,304	1,109	487.0	5.6	167.9	373.9
Mar. 29, 1957	8,099	3,715.3	310.0	1,756.6	1,254.0	203,489	20,168	75,855	37,098	7,914	3,734.1	341.6	1,807.9	1,213.5
Mar. 22, 1957	7,976	3,580.0	323.6	1,836.4	1,197.9	205,521	19,978	77,603	36,886	.....	.....	.....	.....	.....
Mar. 30, 1956	7,694	3,634.9	319.7	1,719.0	1,172.1	198,209	17,333	62,583	33,896	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (88 octane)	11.75-12.25
Premium (96 octane)	13.50-14.00
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	11.00-11.50
Regular (92 octane)	11.25-11.75
Premium (97 octane)	13.00-13.50
Premium (98 octane)	13.25-13.75
California (rack):	
Regular (84 octane)	13.1
Premium (93 octane)	14.1
Premium (96 octane)	15.1
Caribbean area (cargoes):	
Regular (87 octane)	11.00
Premium (93 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	10.00-10.375
Diesel oil (58 d.i. and above)	9.625-9.875
Distillate No. 1	9.625-9.875
Distillate No. 2	9.00-9.375
Gulf Coast (cargoes):	
Kerosine 41-43	10.50-11.00
Distillate No. 2	10.00-10.50
New York Harbor (barges):	
Kerosine 41-43	12.25
Distillate No. 2	11.65
Diesel fuel, 48-52 d.i.	11.95
Caribbean area (cargoes):	
Distillate No. 2	10.00

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude scale (solid in bags or barrels	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
★ Residual fuel (max. 1% S)	$2.25-2.35
Gulf Coast (cargoes):	
Bunker C fuel	$2.75-3.00
New York Harbor (barges):	
Bunker C fuel	$3.30-3.40
Caribbean (cargoes):	
Bunker C	$2.55
California (rack):	
Bunker C fuel, Los Angeles	$2.75-3.00

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	25.5
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	22.25
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	28
200 vis. neutral (180 at 100°), 25 p.t.	26

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.67	....	....	....	....
15-15.9	2.71	....	....	....	$1.89
16-16.9	2.74	....	....	....	1.94
17-17.9	2.78	....	....	....	1.99
18-18.9	2.82	....	....	....	2.04
19-19.9	2.85	....	....	....	2.09
20-20.9	2.89	$2.75	....	$2.62	2.14
21-21.9	2.93	2.77	....	2.64	2.19
22-22.9	2.97	2.79	....	2.66	2.24
23-23.9	3.01	2.81	$3.44	2.68	2.29
24-24.9	3.05	2.83	3.46	2.70	2.34
25-25.9	3.09	2.85	3.48	2.72	2.39
26-26.9	3.13	2.87	3.50	2.74	2.44
27-27.9	3.17	2.89	3.52	2.76	2.49
28-28.9	3.22	2.91	3.54	2.78	2.54
29-29.9	3.27	2.93	3.56	2.80	2.59
30-30.9	3.32	2.95	....	2.82	2.63
31-31.9	3.38	2.97	....	2.84	2.67
32-32.9	3.44	2.99	....	2.86	2.71
33-33.9	3.50	3.01	....	2.88	2.75
34-34.9	3.56	3.03	....	2.90	2.79
35-35.9	3.61	3.05	....	2.92	2.83
36-36.9	3.65	3.07	....	2.94	2.87
37-37.9	3.68	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40 and up	....	3.15	....	3.02	2.95

*Includes Oklahoma, most of Kansas, North Dakota, West Texas (sweet) and North Central Texas. †Low Cold test Gulf Coast. ‡Sour.

Effective dates: California January 17, 1957, east of California, January 3-January 10, 1957; Pennsylvania Grade, January 16, 1957.

Some crudes in North Central Texas and West Central Texas, are on the intermediate schedules.

FLAT PRICES

Louisiana:	
Bienville (distillate)	$3.05
Ville Platte	3.45
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.88
Middle District	4.70
Southwest Pennsylvania	4.41
West Virginia	4.23
Buckeye Grade	4.23
Zanesville Grade	3.27
Illinois Basin	3.15
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.78
Redwater (Alta.) D-3	2.67
Smiley-Viking (Sask.)	2.44
Pembina	2.65

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 40°-40.9°, Puerto La Cruz	3.37
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26.5°-26.9°, Amuay*	2.55
Quiriquire, 16.5°-16.9°, Caripito	2.45
Lagunillas heavy, flat, Amuay or Las Piedras*	2.38
Bachaquero, flat, Las Piedras*	2.23

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.87
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.69
Iraq, 36.0°-36.9°, Tripoli, Banias	2.69
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Gulf-U.S.N.H., clean (USMC+45%)	$4.13
★ N.W.I.-U.S.N.H., dirty (USMC+10%)	2.97
★ Gulf-U.K., dirty (USMC flat)	7.65
★ Gulf-France, dirty (Scale+40%) (55s. 2d.)	7.73

SUPPLY AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

GASOLINE

	Total demand	Refinery production	Stocks end of period†
March 1957*	3,855	3,712	203,000
February 1957*	3,600	3,790	203,800
January 1957	3,655	3,939	197,702
April 1956	3,859	3,557	193,299
March 1956	3,738	3,734	199,698

KEROSINE

March 1957*	378	332	20,000
February 1957*	472	359	21,470
January 1957	613	367	24,019
April 1956	272	299	18,227
March 1956	395	342	17,215

DISTILLATE

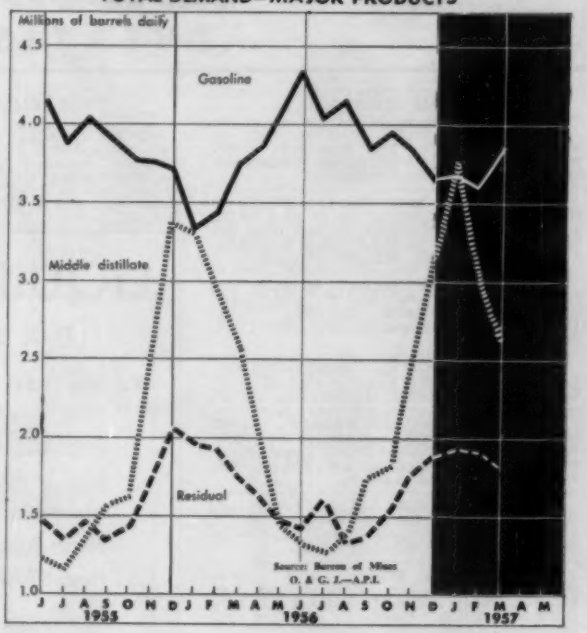
March 1957*	2,237	1,867	75,200
February 1957*	2,570	2,029	85,700
January	3,220	2,118	100,572
April 1956	1,640	1,713	63,571
March 1956	2,173	1,808	60,846

RESIDUAL

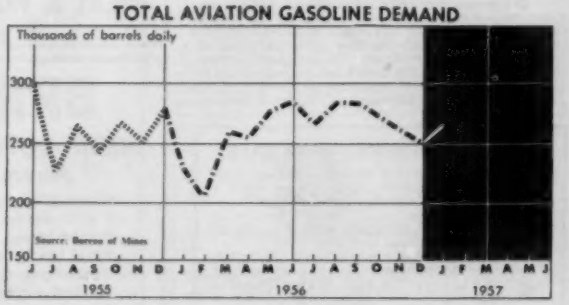
March 1957*	1,822	1,224	37,000
February 1957*	1,922	1,243	37,060
January 1957	2,102	1,322	38,403
April 1956	1,622	1,130	32,740
March 1956	1,754	1,213	32,984

*Preliminary. †Thousands of barrels.

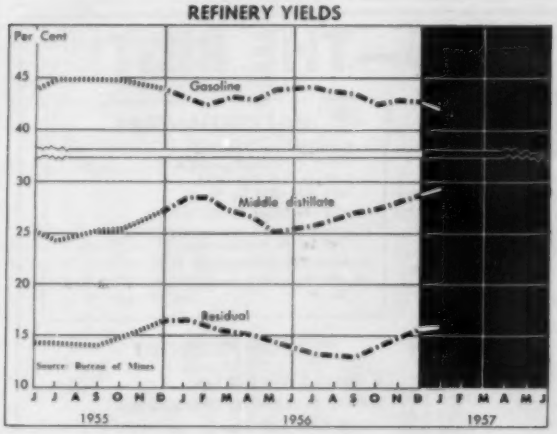
TOTAL DEMAND–MAJOR PRODUCTS



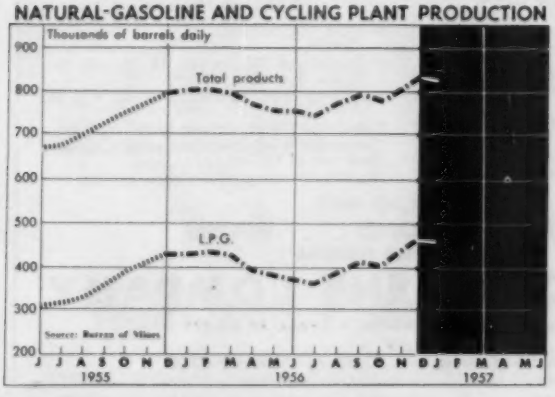
TOTAL AVIATION GASOLINE DEMAND



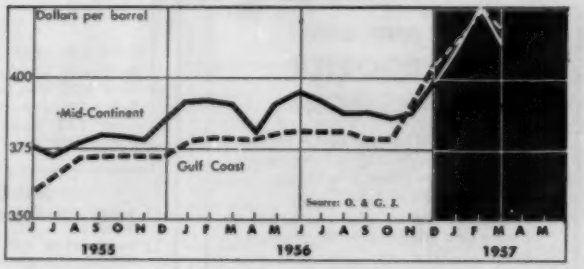
REFINERY YIELDS



NATURAL-GASOLINE AND CYCLING PLANT PRODUCTION



REFINERY REALIZATION



REFINERY REALIZATION

	Mar.* 1957	Feb.* 1957	Jan. 1957	Mar. 1956
Mid-Continent	$4.13	$4.28	$4.12	$3.64
Gulf Coast	4.19	4.25	4.11	3.74

*Preliminary.

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel oil, and residual as published in The Oil and Gas Journal.

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COMPLETE PIPE-THREADING shop. Two Landis machines 13⅜" and 7", with building, fully equipped. Bargain. Phone Diamond 3-9563. Lundquist, Box 1215, Tulsa, Oklahoma.

20 FT. 5-INCH OD drill collars at a bargain price. Ask for Ralph Varel, FI-16467, Varel Mfg. Co., 9330 Denton Dr., Dallas.

FOR SALE—Cardwell Spudder, RL502, complete with tools, equipment necessary for efficient operation. Price, inventory on request. K & A Drilling Co., Phone 448R. Box 497, Ellinwood, Kansas.

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8—Hi-vol pumps, 10 x 7 x 18, 10 x 6 x 12, 6 x 4 x 12, 6 x 3 x 8.

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2—12' x 45' Butane Tanks, 125#
2—12' x 45' Storage Tanks, 25#
1—14' x 21' Clay Towar, 125#
1—8' x 75' Tower, 20 Trays, 25#
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2—8½' x 25' Tanks 50#

HOT-OIL PUMPS

3 Pacific ITB, 400 gpm—2,000' hd, 735 gpm—3,100' hd.
5 Pacific SVTB, 612 gpm—600' hd, 324 gpm—480' hd, 388 gpm—516' hd, 193 gpm—389' hd.
1 Pacific HVTB (unused) 1270 GPM—488' Hd.
8J hot oil pump 3 x 9, 13 st, 325 gpm, 4600' hd.

HEAT EXCHANGERS

3—Kellogg Adm. Flg. Hd. 2200, 1800 Sq. Ft., 315#
4—Kellogg Stel Flg. Hed. 800, 650, 500 Sq. Ft.
18—GR Fin Tubes, 73 Sq. Ft.
6—Brown fintube exchangers, 300# 140 Sq. Ft. 4-6 chrome.
6—Adm. 785, 742, 425 Sq. Ft.
30—304 SS shell & tube condensers 100-1000 Sq. Ft.

COMPRESSORS

1 Worth LTC-6 800 hp.
3 Penn Comps 100 CFM 500 lbs.
385 CFM 160 lbs.

MISCELLANEOUS

6—Bird Centrifugals 32 x 50, 24 x 36, 18 x 28.
5—Sweetland Filters No. 12, No. 10, No. 7, No. 5.
4—Rotary Vac. Filters, 10 x 12, 8 x 10, 5 x 8.
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CORE DRILLS, SPUDDERS, ROTARIES. New and used equipment. Everything in supplies. Fishing tools rented. Pressey & Son, Pueblo, Colo.

PRICED TO SELL: Used 8" x 20" Gardner-Denver FH-FXL Power Slush Pumps. Details furnished upon request. Write Box K-109, The Oil and Gas Journal, Tulsa, Oklahoma.

COOPER WORKOVER-SPUDDER: Complete set of tools, 620 feet casing. 1949 Ford truck. $4,000. C. W. Nole, 6411 E. Haskell Place, Tulsa.

ROCK BITS—Size 9"—Jet and Conventional. Major company surplus stock. Substantial discount. R. L. Bayless Oil Tools, Ponca City, Oklahoma.

NEW LINE PIPE—6⅝"-8⅝", 1250 tons. Complete equipment 1000' wells, used one year. Pipe & Equipment Exchange, 127 E. New York, Indianapolis, MElrose 5-8177.

FOR SALE: Three Type 80 Cooper gas compressors complete with building. Alfred B. Kern, 305 Kennedy Building, Tulsa, Oklahoma.

FAILING 1500, 42' mast, 4½ x 6 pump, 1000' pipe, $8,250.00. 750 Failing, $4,750.00. Others. Fred Butler, Box 481, Pueblo, Colo.

4000' RIG FOR SALE. SM 4000, single drum, truck mounted Franks drilling rig; 60' Franks 4 legged derrick; D-175 Emsco (6¾-12) pump, powered by GMC 6-110A Diesel; drawworks powered by 671 GMC diesel, torque converter; dog house-tool house, float mounted; air conditioned aluminum "Travelite" trailer house, 3½" API modified drill pipe, 3000'; hand tools, subs, 2 light plants, 2 water pumps, 2 5⅛" drill collars. Complete inventory on request. Write Petro-Tex Oil Corp., 900 N.E. Military Dr., San Antonio, Texas. TA 4-2377.

EQUIPMENT WANTED

WANT 2600' good used 3½ drill pipe—6 good 5½ drill collars—payment on per well basis. Box 21, Falls City, Nebr. Phone 3646.

WILL BUY used set of 24 trace seismic instruments; truck mounted. Must be in good operating condition. Century Instruments preferred. Also interested in shooting truck and survey equipment. Box J-995, The Oil and Gas Journal, Tulsa, Oklahoma.

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Modern 15,000 Bbl./Day Refinery

Presently being dismantled — Immediate removal and shipment — exceptional prices

Houdriflow Catalytic Cracking Unit, 8800 bbl./day (new 1952)

TOWERS

8'x5'x85'6" 25 Trays 250 PSI
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6'x30'x½" 9 Trays
4'6"x30'5"x⅜" 14 Trays
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Ethyl Blending Plant 8500 gal. Complete Skimming Pond

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6'x40' SOAKER, 500 PSI @ 850° F.
20'x28'4" AGITATOR, cone bottom
10,000 bbl. HORTONSPHERE
6500 gal. PROPANE TANK

50,000#/hr. Cochrane Water Treating and Deaerating Plant

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Sq. Ft.	Type	Tubes	Shell
1080	Reflux	Adm. 125#	Steel 250#
993	Reboiler	Steel 600#	600
970	"	" 125#	250
750	"	" —	—
331	16-138	Adm. 250#	Steel 250
331	16-138	Adm. 125#	" 250
Brown	Fintube	Steel	600 PSI (11)

110,000 gal. Foamite System—complete

Vacuum Crude Oil Distillation Unit, 15,000 bbl./day (new 1953)

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Your inspection invited—representatives on premises
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PETROLEUM ENGINEER with Master's Degree, or Doctor's in Chemical, Mechanical, or Petroleum Engineering for research and teaching in Petroleum Production Engineering at rapidly growing southwestern institution. Rank and salary open, twelve months employment possible, consulting work encouraged and available in immediate area. Applications will be kept confidential. Box J-902, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

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interested in sales in South America. Production, gas compression, waterflood, etc. or related experience desirable. Knowledge Spanish desirable but not necessary.

Box K-131, The Oil and Gas Journal, Tulsa, Oklahoma.

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PIPELINE ECONOMIC STUDIES

MAJOR CONSULTING ENGINEERING COMPANY

requires

Management Type Man for Developing Economic and Feasibility Reports on Pipeline Systems.

Address:

Box K-118,
The Oil and Gas Journal,
Tulsa, Oklahoma.

SURFACE GEOLOGISTS

(Ages 24 - 38)

Current employment opportunities with a major integrated United States oil company in South America. Openings now exist in an expanding Geological organization at levels requiring from 3 to 8 years of field party experience. Salary, including bonus, from $14,000 to $17,750. Liberal employee benefits and home vacations with travel expenses. Interested experienced Surface Geologists with B.S., M.S., or Ph.D. degrees in Geology are invited to send complete resumes to the address given below. Interviews will be arranged for qualified candidates. All replies strictly confidential.

P. O. BOX 480

NEW YORK 19, NEW YORK

DEPT. A-21

REFINERY SUPERINTENDENT

Opportunity for Present Process Engineer

Independent refiner with modern plant and excellent growth prospects needs refinery superintendent. Will report to refinery manager and supervise all operations and maintenance. Definitely interested in mature chemical engineer with several years process engineering experience in modern rfinery who has the necessary personality, judgment and energy to step directly into high level refinery supervision. Previous supervisory experience desirable but by no means essential for the right man. North Central States location with excellent living conditions.

For consideration, send resume to:

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GEORGE ARMISTEAD and COMPANY

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Petroleum Engineers **Reservoir Engineers** **Drilling Engineers** **Equipment Engineers** **Gas Plant Engineers**	College degree—should have minimum of two years experience in specific field and total of four years in petroleum industry.
Drilling Foremen **Production Foremen**	Extensive supervisory experience with minimum of 10 years in petroleum.
Geologists **Paleontologists**	College degree, plus minimum of four years experience.
Accountants	College degree, plus minimum four years experience in

Attractive salaries and bonuses, liberal benefit plans and vacations, paid transportation, family housing available. Ideal climate. Age to 45.

WRITE—giving age, education, marital status and complete details of experience. Personal interviews will be arranged with qualified candidates.

Box—308-E, Radio City Station, New York 19, New York.

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- Bachelor or Master's degree in Chemical or Mechanical Engineering from a recognized college or university.
- Interest in possibility of future overseas service.

Salary commensurate with background and experience. Liberal employee benefits.

Send detailed resume to:

CALIFORNIA TEXAS OIL COMPANY, LTD.

380 MADISON AVENUE

NEW YORK 17, NEW YORK

c/o Personnel Dept.

HELP WANTED

ENGINEERS—Chemical, Mechanical, Petroleum or Gas Engineering graduates. Major Oil Company will interview applicants for openings in natural gas department. Their area of operations consists of Mid-Continent, Louisiana and Gulf Coast. Salary to suit previous experience. Our employees are aware of this ad. Box K-101, The Oil and Gas Journal, Tulsa, Oklahoma.

SEISMOGRAPH TECHNICIAN fully conversant with recent developments and interpretation, 8-10 years' field practice, wanted to assume responsibilities of supervision and interpretation at headquarters of French oil company in Algiers. Furnish full information on education, experience. Box K-116, The Oil and Gas Journal, Tulsa, Oklahoma.

Operations Engineer

Independent oil company has opening for petroleum engineer with four to seven years experience both technical and administrative for responsible position in planning and control. Knowledge of operating procedures, some valuation work and practical oil and gas law would be desirable. Excellent growth opportunities. Please furnish complete details on qualifications, including starting salary required.

Box J-987,
The Oil and Gas Journal,
Tulsa, Oklahoma.

CHEMICAL ENGINEER

Background preferably in petroleum refining process and operation for important work with international consulting engineering firm. Position involves work with oil, chemical, and related companies, mainly at management level. Requires knowledge of methods, equipment, investments, and economics, accompanied by mature sound judgment and agreeable personality.

Extraordinary opportunity for individual recognition and development with wide contacts in industry. Location in attractive area on Atlantic Coast. Salary commensurate with ability.

Box K-113,
The Oil and Gas Journal,
Tulsa, Oklahoma

HELP WANTED

HELP WANTED

GEOPHYSICISTS

(Ages 26 - 36)

Current employment opportunities with a major integrated United States oil company in South America. We now have openings in our expanding Geological organization for Seismic Interpreters with from 4 to 8 years experience. Salary, depending upon experience and including bonus, from $15,750 to $17,750. Liberal employee benefits and home vacations with travel expenses. Interested experienced Geophysicists with B.S., M.S., or Ph.D. degrees are invited to send complete resumes to the address given below. Interviews will be arranged for qualified candidates. All replies strictly confidential.

P. O. BOX 480

DEPT. A-21

NEW YORK 19, NEW YORK

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— ENGINEERS —

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GAS
DRILLING

RESERVOIR
MECHANICAL
PIPE LINE

Subsidiary operating in Venezuela has opportunities for engineers with/without experience. Salary commensurate with experience.

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Bowling Green Station, New York 4, New York

PALEONTOLOGISTS

(Ages 30 - 38)

Current employment opportunities with a major integrated United States oil company in South America. An opening now exists in an expanding Geological organization for an experienced Senior Paleontologist with proven supervisory ability and know-how to run commercial laboratory. Salary, including bonus, $18,500. Liberal employee benefits and home vacations with travel expenses. Interested experienced Paleontologists with B.S., M.S., or Ph.D. degrees are invited to send complete resumes to the address given below. Interviews will be arranged for qualified candidates. Replies strictly confidential.

P. O. BOX 480

DEPT. A-21

NEW YORK 19, NEW YORK

CHEMICAL ENGINEERS

New staff positions, created by company expansion, are open for chemical engineers with up to ten years experience in refining or petrochemicals technical service, process control, economics or process design.

Write, giving resume, to

PONTIAC REFINING CORP.
P. O. BOX 1581
CORPUS CHRISTI, TEXAS

Micro-Paleontologist and Stratigrapher

Require 6 to 10 years experience plus ability to conduct regional geological studies and to speak Spanish.

Field Geologist

Require 4 to 6 years experience in surface geology and field mapping. Ability to speak Spanish is essential.

Both positions are with a small independent oil company operating in South America. Excellent living conditions. Send full particulars on education and experience, with references to:

James L. Carlton, Jr.
P. O. Box 455
Casper, Wyoming.

HELP WANTED

LANDMAN

Independent Oil Company has opening for experienced Landman. Must know all phases of landwork and have ability to assemble deals and make trade. Geological background preferred. Must have experience and knowledge of Mid-Continent area. Age limit 40. Salary will be commensurate with ability and experience. Reply giving past employment, education, and qualifications. All replies confidential. Reply

BOX K-108, THE OIL AND GAS JOURNAL, TULSA, OKLAHOMA.

MANUFACTURER'S AGENT to represent established manufacturer of Portable Rig Shelters. Prefer agent in Houston with men in New Orleans and Corpus Christi area. Individual representatives in each of the three Gulf Coast areas considered. Reply Box K-102, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER—Aggressive independent oil and gas company has opening for Petroleum Engineer for reserve evaluation. Unusual opportunity for qualified man. Experience desirable but not essential. Furnish resume of experience and education. All replies confidential. Corpus Christi Area. Box J-999, The Oil and Gas Journal, Tulsa, Oklahoma.

Petroleum Geologist

Established Oil Company desires Geologist for employment in West Texas area. Must know area and have three to six years of active experience in subsurface mapping and interpretation. Excellent opportunity for advancement. Salary will be commensurate with ability and experience. Reply should state age, education, experience, and salary desired.

BOX J-996,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

CHEMICAL and MECHANICAL ENGINEERS

A large and expanding international petroleum company has openings for several Chemical and Mechanical Engineers with outstanding ability. This is a challenging opportunity to share the responsibility of coordinating international refining operations. Excellent advancement opportunities for applicants with a minimum of 3 years petroleum or chemical industry experience. Immediate assignment to our Far East refineries or to our White Plains headquarters with an eventual overseas assignment. Salary commensurate with experience, liberal annuity, insurance, hospitalization and savings plans. Will pay moving and transportation expense. Please send background and experience resume to:

DENNIS V. WARD
STANDARD-VACUUM OIL COMPANY
P. O. BOX 1000
WHITE PLAINS, N. Y.

HELP WANTED

FOREIGN EMPLOYMENT. List oil companies, drilling contractors, seismograph contractors, showing where apply foreign jobs. $5.00 cash. OIML Co., Box 2623, Tulsa, Okla.

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for Reservoir & Production engineering in varied types active fields in COLOMBIA, SOUTH AMERICA. Excellent salary, allowances, opportunity obtain additional experience & advancement. Minimum 2 years exp.

Forward Personal data, college transcript, to:

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If you are a chemical engineer with 3 to 5 years experience in refinery process engineering or operation and economic analysis and have an interest in consulting and technical service type work, you should investigate this unique opportunity to capitalize on your background and to participate in the growth of an expanding technical activity of a well-known company allied to the refining industry. This position offers a wide variety of assignments, industry-wide contacts with refining and process companies, for using initiative and originality to increase responsibility A midwest suburban location offers ideal professional environment. Send resume of qualifications to

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The Oil and Gas Journal,
Tulsa, Oklahoma.

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PRODUCTION WANTED

WANTED FOR CASH—Depleted and Marginal Wells for Salvage. Frank J. Black, P. O. Box 150, Phone 107, McPherson, Kansas.

WANT TO BUY—Oil Properties, settled or semi-settled production. 100 to 5,000 barrels daily in Oklahoma and Kansas. Contact Morris Sitrin, 1215 First National Building, Tulsa, Oklahoma.

PRODUCING oil, gas properties, also royalties wanted. Any size, any amount. Complete details in first letter. Box 231, Scarsdale, N. Y.

SITUATIONS WANTED

DISTRICT GEOLOGIST: Age 30, veteran, married, B.S. degree, experienced in West and West Central Texas, Southeast New Mexico, some in Canada and Gulf Coast, desires position with aggressive small company or independent in Texas. Excellent references. Box K-100, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER: Fifteen years experience process design, economics, project planning and coordination in petroleum and petrochemicals, desires responsible engineering position or technical sales requiring process background. Box K-111, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING SUPERINTENDENT with administrative experience. Employed 20 years in Mexico and South America. Capable of assuming entire responsibility of drilling operations. Desires foreign employment. Box K-106, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST—experienced Kansas, Okla., Colo. geology, leasing, deals, drilling, seeks connection independent group desiring representative. Data currently maintained. Box K-120, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE PETROLEUM ENGINEER—28, married, veteran. 3½ years pre-graduation oil field experience, 2 years engineering in drilling, production, gas pipelines. Currently employed. Prefer South Texas. Box K-119, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER—Experienced all phases of pump station and pipe line design, construction and operation, capital cost estimates, economic studies and reports. Registered Professional Engineer. Desires engineering-management position with oil company, contractor or independent. Box K-122, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER: Age thirty-six. Ten years experience major oil company in process and project engineering, construction and operation of gasoline and cycling plants and compressor stations. Familiar with gas and products sales contracts. Employed in supervisory capacity. Capable managing gas operations. Prefer medium sized company. Will consider position with opportunity with contractor. Box K-115, The Oil and Gas Journal, Tulsa, Oklahoma.

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HAVE 3500 ACRES in McKenzie County, North Dakota for drilling deal. Will need ten thousand ft. test. Good geology. Albert Arnegard, Jr., Arnegard, North Dakota.

BARTLESVILLE SAND. 4 wells, 240 acres. 50 bbl. daily natural. Greenwood County, Kansas. Write Box 582, Eureka, Kansas.

NOW BEING LEASED Forrest City Basin in Iowa. Can I assist you? A. J. Barrett, P. O. Box 122, Siloam Springs, Arkansas.

320 ACRES offset to well that made 400 feet free oil in drillstem test between 1600 and 1700, oil 40 gravity. This acreage donated for well. Box K-123, The Oil and Gas Journal, Tulsa, Oklahoma.

NEED CAPITAL to prove 160 acre lease in Creek County, Okla. Will sell half interest. Will drill thru Prue and Red Fork sands to Bartlesville sand. Frank Root, Rt. 2, Box 113, Bristow, Okla.

OIL, GAS AND MINERAL LEASES available in Dell City area of Hudspeth County, Texas. U. S. Geological Survey Map shows anticlinal axis nearby favorable for oil-gas structure. Am fee landowner of over 2000 acres. Write quickly to: Jefferson G. Smith, 215 Littlefield Building, Austin 15, Texas.

CHAVES COUNTY, N. M.
MAJOR OIL STRUCTURE

MAJOR CO. BLK.: Well to drill PENN, DEVONIAN & ELLENBURGER OIL ZONES. Subsurface & Base Map Indicate Major Field. Royalty & Close In Interests. Data on request to those who Value Great Potential.

W. J. PETERMAN, Geologist
Exploration 1918-1957 Engineering
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FINANCIAL CONTACTS. Underwriters. Brokers, Private Finders of Capital reached. No shopping. Confidential. FREE ENTERPRISE ASSOCIATES, 617 51st St., Brooklyn, N. Y.

WANTED PARTIES to join me in drilling 80 acres, northwest extension of Livingston pool drilled in North half of Section 16-17-15 where wells came for 600 barrels per day. Close to the Big play in the Arbuckle pay, first well reported 1,000 barrels per day. Good chance to get in on a Big Play. ¾ interest $6,000.00, ½ interest $4,000.00, ¼ interest $2,000.00, ⅛ interest $1,000.00. 1/16 interest $500.00, 1/32 interest $250.00. Reduction in cost per interest if production is found above Mississippi Lime. If interested I will send you Map and printed Sheet discussing the lessibilities of lease. Write O. A. Sewell, P. O. Box 103, Coweta, Oklahoma.

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Box J-994, The Oil and Gas Journal, Tulsa, Oklahoma.

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Reports—maps—newsletter

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Mail: Apartado 3983
N. VanMiddlesworth
Phone: 54 48 62

LEGAL

SEALED BIDS will be received until 2:00 P.M., Mountain Standard Time, April 23, 1957, and opened at that time in the Office of the Uintah and Ouray Indian Agency, Fort Duchesne, Utah, for the leasing of 640 acres more or less, of Allotted Indian lands in thirteen separate parcels, located in Sections 22, 23, 26, and 27, Township 1 South, Range 1 West, Uintah Special Base and Meridian, Uintah and Duchesne Counties, Utah, for oil and gas mining purposes. The details of the lease offering and filing of bids may be obtained by addressing an inquiry to Superintendent, Uintah and Ouray Agency, Fort Duchesne, Utah, or to the Regional Oil and Gas Supervisor, U. S. Geological Survey, Casper, Wyoming.

LEGAL

SEALED BIDS will be received until 10:00 A.M. Mountain Standard Time, and opened at that time in the office of the Navajo Indian Agency, Window Rock, Arizona, on the following tracts of Navajo allotted lands on the dates as indicated as follows:

GROUP I: Bids to be Opened
Tract Nos. 1 to 210 inclusive 4-25-57
GROUP 2:
Tract Nos. 211 to 399 inclusive 5-16-57
GROUP 3:
Tract Nos. 400 to 564 inclusive 6-6-57

The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the General Superintendent of the Navajo Indian Agency, Attention: Branch of Realty, Window Rock, Arizona.

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LEGAL

SEALED BIDS will be received until 2:00 P.M., Mountain Standard Time, April 24, 1957 and opened at that time in the Office of the Superintendent, Blackfeet Indian Agency, Browning, Montana, for the leasing of 3,490.91 acres of Tribal land 1,240.00 acres of allotted Indian land located in Townships 32 North, Range 6 West and 36 North, Range 6 West, P.M.M., Glacier County, Montana, for oil and gas leasing purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of the Blackfeet Indian Agency, at Browning, Montana. R. E. Miles, Acting Superintendent.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Cheyenne, Wyoming. Notice is hereby given that approximately 2327.93 acres of land in 17 parcels within the known geologic structures of the Fourbear and Little Buffalo Basin fields, Wyoming, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre through sealed bids on or before May 8, 1957, when bids will be opened. Details of the lease offering, and how and where to submit bids, may be obtained from the Land Office, Cheyenne, Wyoming. Arvin H. Olswold, Acting Manager.

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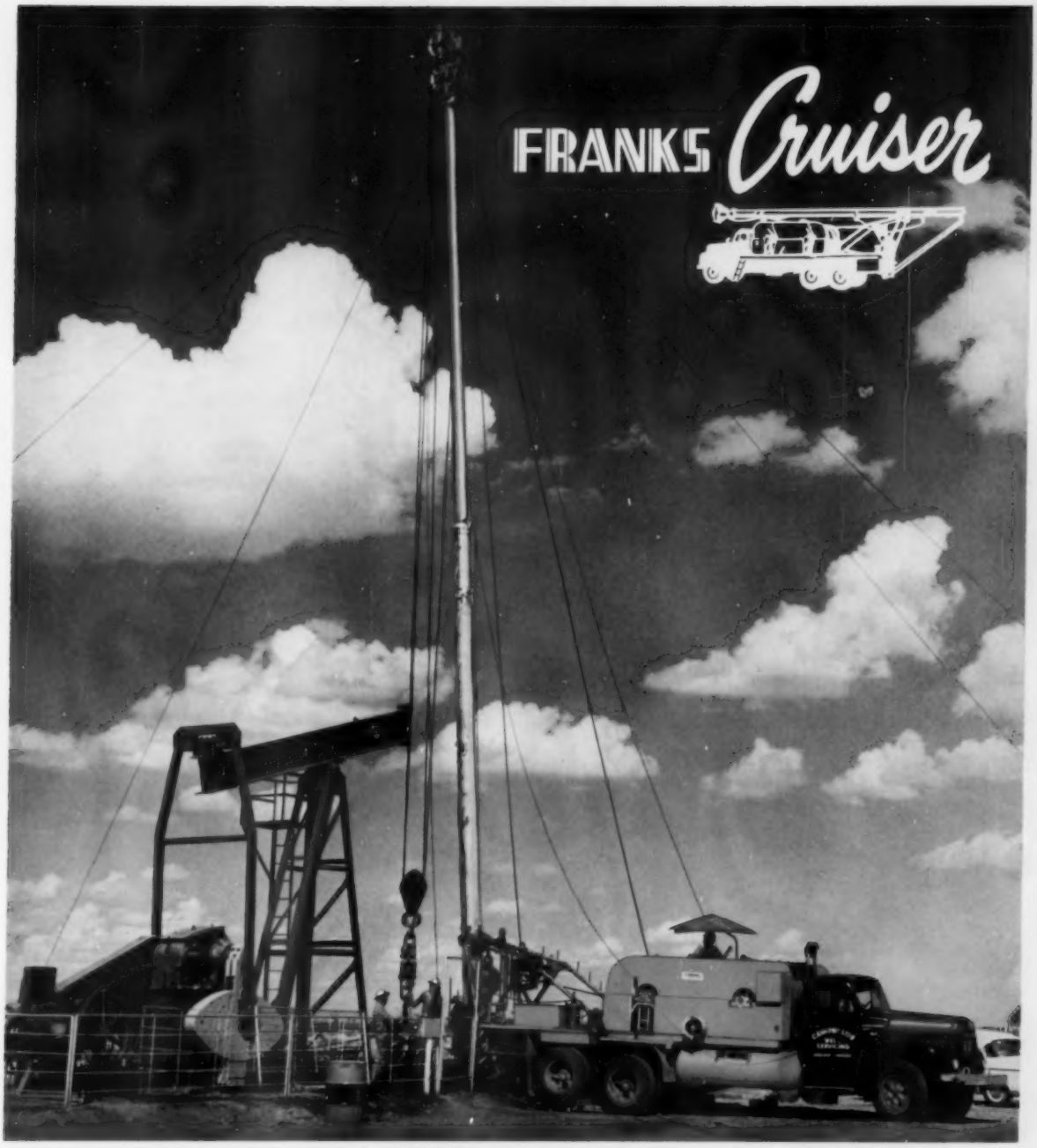

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